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DISEASES

of the

CHEST

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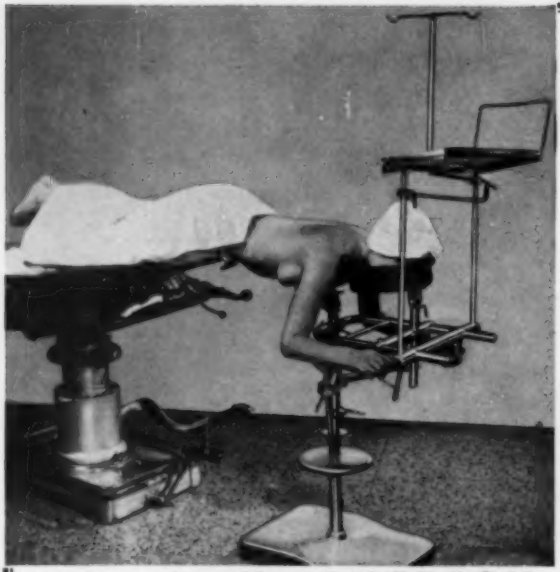

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CONTENTS:

DECORTICATION OF THE UNEXPANDABLE PNEUMOTHORAX LUNG.... 1
David H. Waterman, M.D. and Sheldon E. Domm, M.D., Knoxville, Tennessee

SUPERIOR VENA CAVAL SYSTEM OBSTRUCTION..... 19
Malcolm C. McCord, M.D., Philip Edlin, M.D. and Malcolm Block, M.D., Dayton, Ohio

THE LEUKOCYTIC PATTERN DURING STREPTOMYCIN TREATMENT OF PULMONARY TUBERCULOSIS..... 28
L. S. Arany, M.D., Walla Walla, Washington

THE EFFECT OF PNEUMOPERITONEUM ON THE ELECTROCARDIOGRAM..... 36
A Study of the Results Obtained with Standard and Unipolar Leads
Ann Pollak, M.D., Trudeau, New York

THE ROLL OF BRONCHOSCOPY IN ARTIFICIAL PNEUMOTHORAX..... 58
George R. Hodell, M.D., Houston, Texas

BRONCHOGRAPHY IN PULMONARY TUBERCULOSIS..... 66
Paul Rabinowitz, M.D. and Ian S. H. Harper, M.D., Hamilton, Ontario

COMPLICATIONS OF PNEUMOTHORAX AND PNEUMONOLYSIS..... 78
L. H. Strug, M.D. and R. M. Shepard, M.D., New Orleans, Louisiana

KARTAGENER'S TRIAD..... 92
Review of the Literature and Report of a Case
H. S. Zuckerman, M.D. and L. R. Wurtzebach, M.D., Fort Logan, Colorado

TUBERCULOSIS AND PRIVATE HEALTH..... 98
Joseph D. Wassersug, M.D., Quincy, Massachusetts

ADDRESS 104
Miguel Cañizares, M.D., Philippine Islands

A MODIFICATION OF THE JACKSON BRONCHOSCOPE..... 107
A. Albert Carabelli, M.D., Trenton, New Jersey

THE PRESENT STATUS OF VACCINATION IN TUBERCULOSIS CONTROL PROGRAMS 110
Council on the Management and Treatment of Diseases of the Chest.

COLLEGE NEWS 112

COLLEGE CHAPTER NEWS 116

COLLEGE NEWS NOTES 120

ALVAREZ SUCCEEDS ALBRECHT AS EDITOR OF "GP"..... 121
J. A. Myers, M.D.

MEDICAL SERVICE BUREAU..... 124

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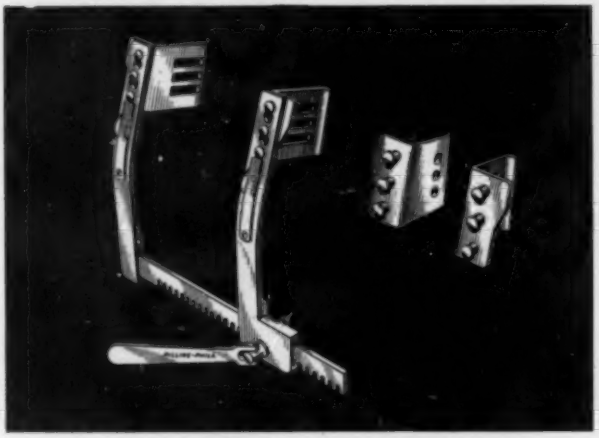

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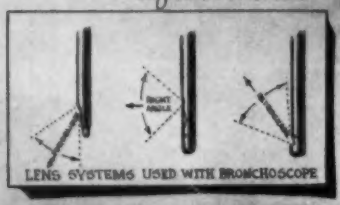

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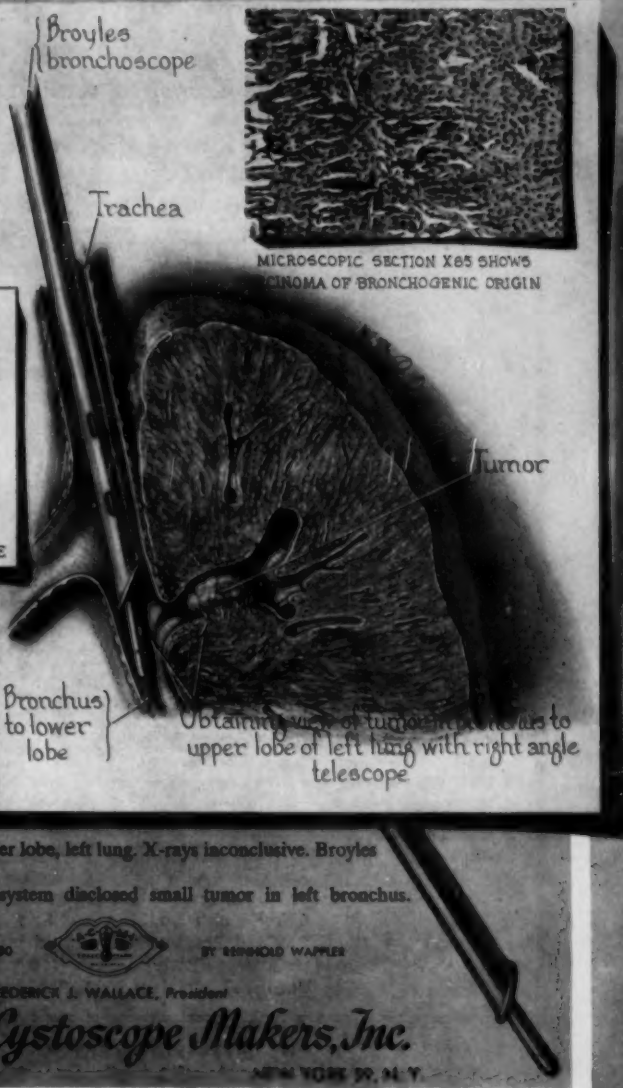
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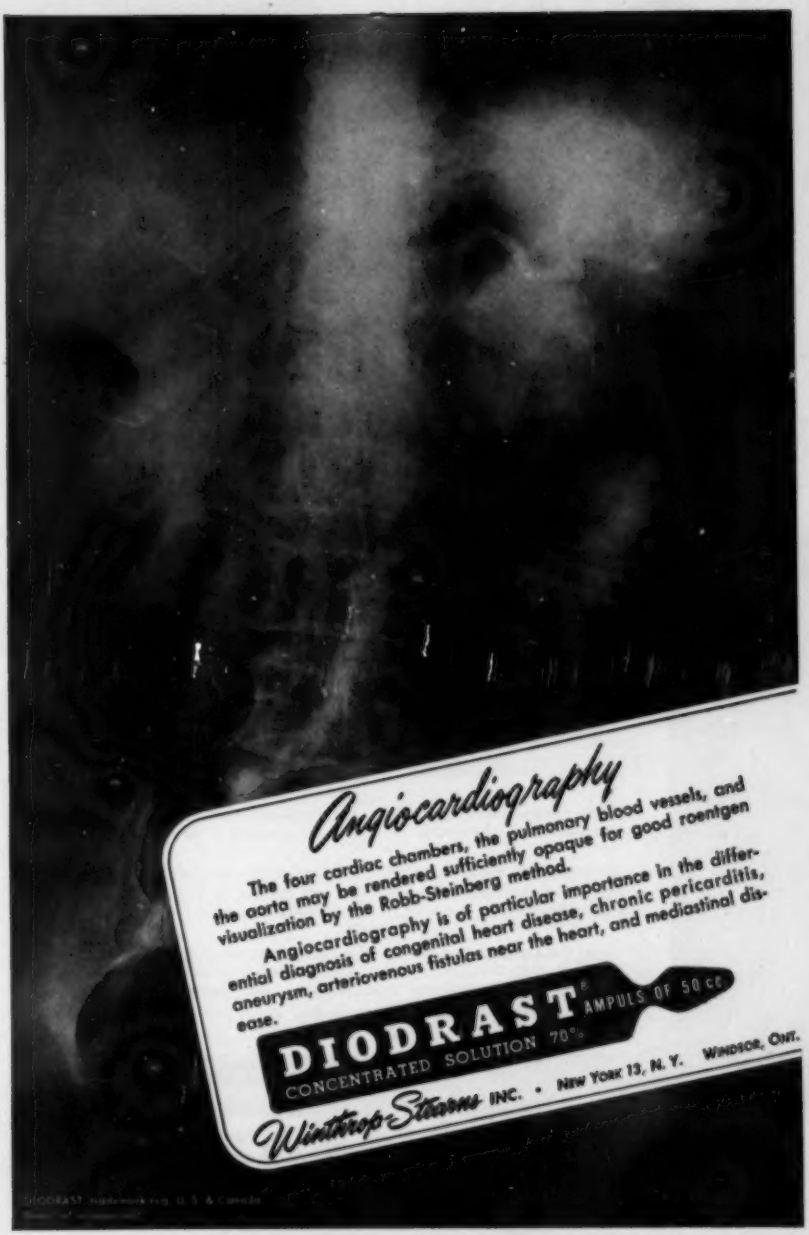
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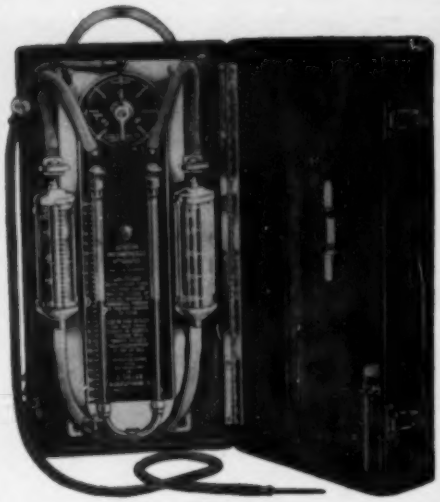

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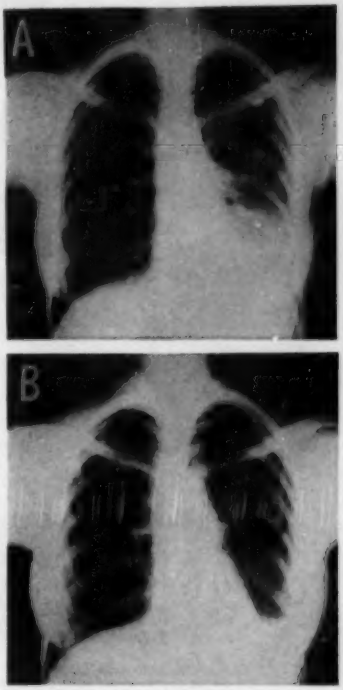

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DISEASES *of the* CHEST

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Decortication of the Unexpandable Pneumothorax Lung*

DAVID H. WATERMAN, M.D., F.C.C.P. and
SHELDON E. DOMM, M.D., F.C.C.P.
Knoxville, Tennessee

The feasibility of decortication of the unexpandable pneumothorax lung occurred to one of us (D.H.W.[1]) in 1945 incidentally in the course of a pneumonectomy for carcinoma arising in a tuberculous lung collapsed by pneumothorax for some three and one half years. Efforts at re-expansion had been unsuccessful for seven months, yet the visceral peel stripped with ease and the lung re-expanded readily. The same phenomenon had also been noted several months before when a decortication was successfully performed on a lung unexpandable because of persistent pleural effusion. Although tuberculosis was not proved as the etiological agent, the similarity of the peel to that found in the unexpandable pneumothorax lung was striking. Both of these cases strengthened our belief that the operation would find a place in tuberculosis surgery.

Our interest in applying the operative technique of decortication as the procedure of choice on a wider scale, however, was aroused by the enthusiasm engendered by the development of new refinements in the old procedure as applied to non-tuberculous empyema during the last war,[2] and by the advent of streptomycin.

Historical Background

The rationale of obliteration of the pleural space in chronic empyema has been recognized for many years. Fowler in 1893 and Delorme in 1894 outlined the principle of freeing the lung in order to permit it to re-expand and fill the pleural space.

During the first World War, Eggers[3] applied this principle, and

*Presented at the Sixth Annual Meeting of the Southern Chapter of the American College of Chest Physicians, Cincinnati, Ohio, Nov. 14, 1949.

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in 1923 published a large series of decortications for chronic empyema. Of particular interest was his accidental inclusion of 11 tuberculous empyema cases, three of whom were cured. This fortuitous occurrence encouraged him to try the procedure intentionally on six cases, three of these enjoying apparent recovery. In spite of these encouraging results the procedure failed to gain wide acceptance, possibly because of the high incidence of tuberculous spreads encountered, as later suggested by Meade.[4] The introduction of streptomycin by Waksman in 1944 would seem to have been the partial solution to this problem.

The other inhibitory factor may have been the fact as stated by Samson that "the operation is one of considerable magnitude." It is in this connection that the contributions of the decades since the first World War, notably intratracheal anesthesia, the blood bank, and penicillin have extended the applicability of the procedure.

Gurd[5] revived interest in decortication in tuberculous empyema in May, 1946, when he presented three successful cases at the meeting of The American Association for Thoracic Surgery. At the same time Mulvihill[6] reported a case performed for nonexpandable lung following longstanding pneumothorax.

Subsequently Mulvihill and Klopstock,[7] O'Rourke, O'Brien and Tuttle,[8] Weinberg and Davis,[9,10] Gordon, Brook and Welles,[11] Wright, Yee, Filley and Stranahan,[12] Himmelstein, Miscall and Kirschner,[13] and Lam[14] have published on the subject.

Alternatives, Aims, and Indications

Prior to the advent of decortication, several alternatives, all undesirable, have faced the phthisiologist who was confronted with the problem of a lung bound down with what we at one time erroneously called thickened pleura: (a) The pneumothorax could be continued with refills for an indefinite period. Sooner or later, however, effusion or empyema resulted in a preponderant number of cases. (b) The pleural space could, at times, be obliterated by so-called "false re-expansion," that is, by overdistension of the contralateral lung with accompanying mediastinal shift, elevation of the ipsilateral hemidiaphragm, and contraction of the chest wall. Marked diminution of function, in the pneumothorax lung from contraction, and in the contralateral lung from overdistension, resulted. (c) The space could be mechanically collapsed by thoracoplasty, usually an extensive procedure. Even with complete rib resection, residual pockets were not uncommon. Function loss in the involved lung was usually complete. Deformity, because of the extensiveness of the surgical procedures demanded, was often rather marked. (d) If effusion occurred, the space could be per-

mitted to fill with fluid. The dangers of such a course are obvious. (e) If tuberculous empyema had resulted, oleothorax could be instituted, were thoracoplasty not feasible. Although every tuberculosis specialist has seen instances of success in such cases, the general principle of introduction of a foreign substance into the pleural space is surgically unsound. The empyema is not sterilized by the procedure, and attendant well known hazards persist.

Needless to say, none of these alternatives is pleasing to the mind of the surgeon, whose objective should be the restoration of as near normal function as possible. The operation of pulmonary decortication is more satisfying in that it both tends to obliterate the pleural space, and to restore or preserve a maximum of pulmonary function.

At the present time there seems to be little controversy regarding the first of these aims. The second, however, is a matter of great concern to all the workers in the field.

Studies are now in progress in various clinics, notably that of Wright at Saranac Lake, undertaking to clarify the interesting fact, clearly expressed by Gordon, that as much improvement in function may not follow decortication in tuberculosis as is seen in uncomplicated cases of hemothorax or pyothorax. Decreased oxygen saturation actually may result. Gaensler,[15] however, in unpublished data, reports encouraging progressive improvement in pulmonary function in a small series of cases.

All thoracic surgeons await with eagerness the results of these carefully controlled studies. Meanwhile it might be observed that in a good percentage of candidates for decortication in private practice the desirability of obliterating the pleural space seems of greater practical importance than improvement of an already clinically adequate pulmonary function.

We feel that studies such as those of Wright, when evaluated over a period of years, will permit the establishment of criteria for operability. Thus certain cases, for example those having a small upper lobe cavity without significant surrounding infiltration, will probably prove to be ideal candidates for the procedure. Other cases with more extensive fibrosis may be expected to benefit in one way by obliteration of the pleural space but to be made worse in the sense of overdistension of lung tissue. In these instances it would seem a rather simple matter to subsequently provide some other means of selective collapse, such as thoracoplasty or phrenic interruption, as already advocated by Weinberg. Other cases with still more widespread involvement may come to be considered contraindications for the procedure. Briefly it might be predicted that if patients are well selected for pneumothorax therapy, they should do well with decortication. It can be un-

equivocally stated that indiscriminate submission of patients to decortication, as in the case of any new operation, will cast discredit on the regimen. Judiciously used, the operation can salvage some of the poor results that have constituted a deterrent to pneumothorax therapy in the past.

The indications for pulmonary decortication for complications of pneumothorax may be listed according to the modified outline of O'Rourke, et al:

(a) Fluid.
(b) Empyema.
(c) Failure of the lung to re-expand satisfactorily after pneumothorax has been abandoned.
(d) So-called "false re-expansion," i.e. obliteration of the pleural space by extreme shifting of the mediastinum and over-expansion of the opposite lung.

It should be assumed, of course, that failure of the involved lung to re-expand properly has been proved, insofar as is possible, to be due to the presence of a fibrin peel, and not due to extensive pulmonary fibrosis or atelectasis, or to endobronchial tuberculosis with bronchostenosis.

Technique

We have in general followed the well known and now standard technique described by Samson and Burford.[16] However it might be of value to note a few points on details arising in the course of our experience, and on certain controversial matters. We ordinarily employ a postero-lateral approach via the sixth intercostal space, without rib section or resection. We feel this last detail is important in restoring chest wall function. The incision in the sixth intercostal space usually exposes the main interlobar fissure, another advantage.

Almost invariably the intercostal spaces are contracted. In dividing the intercostal structures down the center we have found the Inge bone spreader* to be an instrument of particular value (Figure 1). The nose of the instrument can be inserted between the ribs through a very small incision, and the ribs forcibly separated to the maximum distance. The incision can then safely be carried down midway between the ribs until the parietal peel is incised. We have found it comparatively easy to develop a cleavage plane between the parietal peel and the parietal pleura. After separation of the peel on either side of the incision, a rib spreader can be inserted and the exposure steadily improved as the peeling proceeds.

*Manufactured by Richards Manufacturing Company, Madison Avenue, Memphis, Tennessee.

We remove the peel not only from the lung but also from the chest wall, as also advocated by Weinberg, but not by Tuttle. We do this because we believe the thick inelastic parietal membrane limits intercostal excursion and serves as a possible focus of infection, and also because we have found it technically easier to free the lung after developing the plane of cleavage on the chest wall side. We readily admit that this is not feasible in all cases: certainly where the risk is grave, removal of the visceral peel first is desirable, inasmuch as space obliteration might be obtained by this maneuver alone should the operation have to be terminated. If such action proves necessary, the visceral cortex is best approached after incision of the peel at the mediastinal reflexion.

It has been said that the parietal peel absorbs, and this may of course be true. However we venture to raise the question whether x-ray signs of narrowing of the so-called "thickened pleura" can validly be considered evidence of complete absorption of the peel. We have had the experience of planning a rather limited decortication for a partly expanded lung only to find that the fibrin envelope extended in significant manner into the region apparently satisfactorily re-expanded on x-ray inspection.

We also attempt to free the diaphragm, feeling that the greatest possible excursion is desirable in the immediate postoperative period in order to bring about optimal re-expansion and expectoration of bronchial secretions. From a longer term viewpoint, the ability of the diaphragm to rise as high as necessary in order to compensate for poor expansion in areas of pulmonary fibrosis may ameliorate the tendency towards reactivation and emphysematous over-compensation feared by some writers. We have noted the tendency of the hemidiaphragm to remain elevated, though functional, with no apparent ill effect.

In this connection we might say that care should be taken to

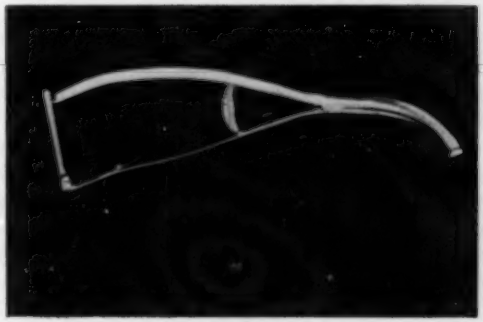

FIGURE 1

avoid trauma to the phrenic nerve. In two of our cases we inadvertently caused apparently complete phrenic paralysis; the patients however have continued to do well, and show no discernible functional impairment from a clinical standpoint.

In removal of the visceral peel special attention is devoted to areas of infolding of lung, a simple point but one easily overlooked. After the main visceral peel has been separated, numerous fragments of peel of varying thickness may be found at points over the lung surface. Some of these separate with ease, others with considerable difficulty. On the basis of our observation, the surgeon need not worry if in his attempts to find a satisfactory plane of cleavage he should actually strip away a portion of the visceral pleura. We have found that the denuded surface thus produced behaves essentially as the raw lung surface encountered following segmental resection, and warrants no special management.

We have also observed, as have most surgeons who have attempted decortication, that there may be several layers of peel, with easily developed cleavage planes between them. Apparently they may be laid down during recurrent episodes of fluid, thus building up a laminated peel somewhat analogous to the rings of a tree. Needless to say, it is important to develop the plane of cleavage between the peel and the pleura itself. It might be stated at this time that a restricting peel can develop in the absence of discernible fluid.

If the lung is to re-expand satisfactorily, complete freeing of all fissures is of great importance. As a matter of fact, the best guide to the surgical maneuvers necessary is the appearance of the partially freed lung under positive pressure. Infolding and bound-down areas are clearly demonstrated.

Study of the original x-ray films will guide the surgeon as to how much of the visceral peel should be removed. One of the advantages of the operation is that the decortication can be done selectively, leaving a protective segment of peel over the area of parenchymal disease. We feel this maneuver affords protection in preventing the strain of expansion in fibrotic areas. In several of our cases, where apical disease was present, we have left an area of peel which on re-expansion of the lung resembles the familiar "pleural cap" in the x-ray film.

Unless air leaks are rather extensive, we do not attempt aerostatic suture. It is important, however, to loosely tack up to the parietes or along the fissure any segment of the lung which might prolapse before adequate and permanent aeration has been established.

We use more blood than some workers, averaging 3,250 cc. per

case in our series. This, as may be suspected, may be due in part to our routine removal of the parietal pleura. However blood is easily obtained, and if a more satisfactory end result can be anticipated, a few additional units of blood seem a rather cheap price to pay.

Closed intratracheal cyclopropane anesthesia has been routine. Sodium pentothal induction and curare have been used at the discretion of the anesthetist.

We routinely place two intercostal fenestrated rubber catheters in the pleural space, one anteriorly and one posteriorly, and apply vigorous constant suction postoperatively. We have seen unfortunate complications, namely re-collapse of the lung, occur following premature withdrawal of the tubes; hence we try to be certain that the lung is fully expanded and adherent before we remove both catheters. It is usually advisable to remove one at a time, permitting the anterior tube to remain at least a day after the space seems obliterated on x-ray inspection. As a rule, apparently satisfactory pleural symphysis has been achieved in our cases in a week or less.

Bronchoscopy is usually performed at the close of the procedure, inasmuch as there is almost always some blood leakage into the bronchial system from the traumatized visceral surface. Bronchoscopy not only removes this, but stimulates the effective postoperative cough so helpful in promoting adequate re-expansion. Should the indication arise, subsequent bronchoscopy is of course made available to the patient. Special attention is devoted to the encouragement of cough and deep breathing, turning, and later to selective breathing exercises. As to this last, rehabilitation work during the last war clearly demonstrated that remarkable return of chest wall function could be accomplished through assiduous training. Early ambulation is desirable when feasible.

We are in full agreement with Weinberg that streptomycin protection is perhaps the most responsible factor in the uniformity of good results. Neither reactivation of the parenchymal disease nor tuberculous wound infection has occurred in any of our cases, an experience similar to that of Weinberg. Wound healing per primum is the rule. We[17] have used dihydrostreptomycin in doses of 0.5 grams every 12 hours for a week preoperatively, and have continued it postoperatively until the temperature has been normal for four or five days. Since a frank tuberculous empyema was not present in any of our cases included in this report, we felt justified in this conservative administration. When empyema is present, or there is reasonable assurance the parenchymal disease is unstable, continuation of the streptomycin for at least five weeks postoperatively would seem justified. We have routinely

TABLE I: DECORTICATION OF THE UNEXPANDABLE PNEUMOTHORAX LUNG (Summary of Cases)

Patient	Age	Sex	Original Lesion	Duration of Pneumothorax	Pneumothorax Complication	Duration of Fluid	— RESULT OF DECORTICATION, RE: — Closure of Space	Clinical Function
I.C 11/8/48	44	M	1.3 cm. cavity RUL	39 months	Bloody fluid (sterile)	Clear 33 mos. Bloody 4 mos.	Complete with rise of diaphragm	Good
M.R. 11/26/48	39	F	3.0 cm. cavity RUL	61 months	Fluid	31 months	Complete with rise of diaphragm	Good in spite of phrenic paralysis
M.T. 2/25/49	22	F	2.0 cm. cavity LLL	66 months	Fluid and Fibrin ball	66 months	Complete with rise of diaphragm	Good
M.B. 5/27/49	26	M	2.0 cm. cavity LUL	74 months	Fluid	Over 36 mos.	Complete with rise of diaphragm	Good in spite of phrenic paralysis
E.H. 6/10/49	38	M	3.5 cm cavity RUL	43 months	Fluid	28 months	Subtotal* (apical pocket)	Good
M.O. 11/4/49	45	M	2.0 cm. cavity RUL	43 months	Bloody fluid (sterile)	9 months	Satisfactory early results (with bullous emphysema)	Apparently satisfactory post-operative ie. breathing capacity

*Now complete, 12/17/49. X-ray film shows bullous emphysema.

used repository penicillin, 400,000 units per day, for 24 to 72 hours preoperatively. To forestall pleural contamination through the drainage tubes, penicillin G potassium is administered postoperatively in doses of 50,000 units or more every three hours until the temperature has been normal for at least two days, after which time repository penicillin is continued if the pleural space has not been obliterated. When each tube is removed, 200,000 units of penicillin and one gram of streptomycin are instilled. Although we have not felt it necessary in any of our cases, irrigation with penicillin, streptomycin, or both might be justified in some cases.

Complications

In the limited series of this report, there have been no deaths nor unmanageable complications. It might be of benefit to others, however, to mention some of the troubles we have encountered.

Tension pneumothorax occurred on the table immediately postoperatively in one case, demanding emergency decompression. This, of course, should be prevented by connecting the intercostal tubes to an underwater seal prior to closure of the pleura. Subcutaneous emphysema of a disturbing degree has developed in two cases. The complication was due in one case to tube blockage, in the other to ill-advised early removal of both fenestrated catheters. The phrenic nerve apparently was damaged in two cases, as before noted. We have not entered the pericardium, diaphragm, or a major vessel, but these accidents are ever-present dangers. We have had no infections nor tuberculous reactivations to date. Further observation of cases is obviously indicated.

Bronchial block, though fortunately avoided in our series, can easily occur. Bronchoscopy is indicated if tracheal aspiration and vigorous coughing fail to afford relief. Before thorough sealing of air leaks has taken place, atelectasis alone or prolapse with atelectasis of all or part of the lung may develop. The same remedial measures as for block may be employed, as well as continued suction of course. Although we have not had persistent bronchopleural fistulae, secondary aerostatic sucture might be indicated if a leak persisted. Inevitably some blood loss will continue for a variable period following operation. In no case has this assumed serious proportions. Careful evaluation of the blood picture should be made at frequent intervals in the postoperative period, with blood replacement as indicated. We lean rather heavily on hematocrit (P.C.V.) determinations during this period.

Results

No decortications other than those done for unexpandable pneumothorax lung were included in this series, as shown in Table I.

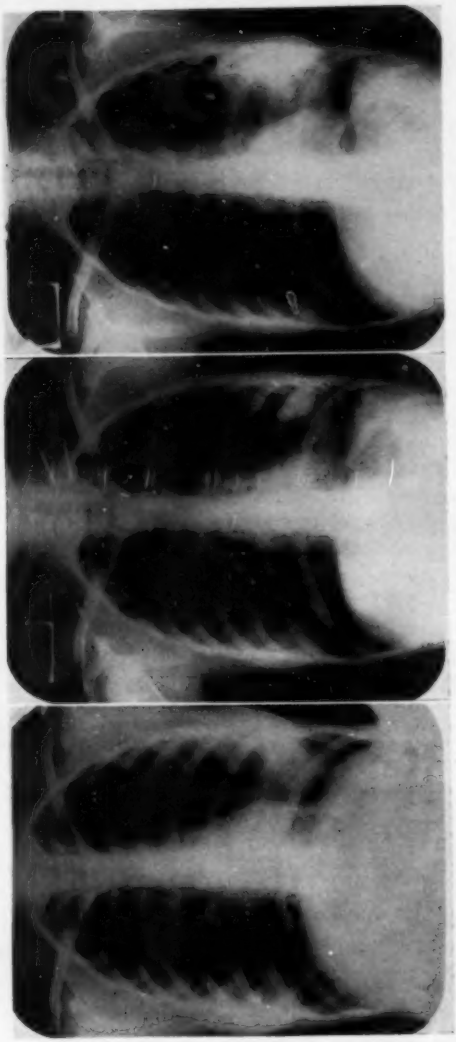

FIGURE 4

FIGURE 3

FIGURE 2

There were six in this category, all of whom had a single isolated cavity varying from 1.3 cm. to 3.5 cm. in diameter on the original x-ray film. All were sputum negative at the time of operation, the pneumothorax having been in effect from 39 to 74 months. Fluid was present in all cases, being bloody in two. In no case was the fluid frankly purulent, nor had repeated smear and culture studies revealed tubercle bacilli. Fluid had persisted in varying amounts for periods ranging from nine to 66 months during the course of pneumothorax therapy.

In all six cases the clinical results have been uniformly satisfactory, every patient expressing enthusiasm regarding the relief from the complaint which caused them to submit to operation, that is, endless pneumothorax refills or thoracenteses, or debilitating bloody fluid. All the patients claim to be improved insofar as they are concerned, and contend that their breathing capacity seems greater. This observation may reflect the inadequacy of the series statistically, and the fortunate selection of cases for operation.

Satisfactory obliteration of the pleural space occurred in all

FIGURE 5

but one case, in which a small pocket still remains at the cupola.*

We might add that in several cases there has been imperfect re-expansion of the apex, intentionally planned and brought about by not removing the peel from an area of involved lung. As might be anticipated, there has been variable rise of the diaphragm in every instance.

The postoperative course has not always been smooth, as noted under complications, but it is gratifying to reflect on the continued improvement seen on serial x-ray films.

Case Reports

The following cases are illustrative of the satisfactory results obtained:

M.T., a 22 year old white female, the onset of whose pulmonary tuberculosis apparently occurred in December, 1942 as an infiltrative lesion in the left lower lobe and pleurisy with effusion of the left. The diagnosis was established July 20, 1943 by positive sputum and x-ray evidence of a 2 cm. cavity in the left lower lobe (Figure 2). Left pneumothorax was induced August 1, 1943. Pleural effusion occurred early, and on June 2, 1945 a fibrin ball was present following disappearance of the fluid

*Subsequent follow-up has shown obliteration of this space (December 17, 1949).

FIGURE 6

(Figure 3). The sputum was converted by August 20, 1943. Re-expansion was begun January 7, 1947, but was unsatisfactory in spite of a left phrenemphraxis on February 7, 1948 (Figure 4).

Decortication on February 25, 1949 was uneventful (Figure 5), and the results one year later are considered satisfactory with regard to complete obliteration of the pleural space, and to clinical function (Figure 6).

I.C., a 44 year old white male was diagnosed as having pulmonary tuberculosis in 1933, and apparently responded to treatment consisting of one year's rest. The disease recurred in 1937, and again subsided under a rest regimen. The second recurrence in February, 1945 was characterized by a 1.3 cm. right upper lobe cavity (Figure 7).

Right pneumothorax was induced April 12, 1945 (Figure 8). There was an early appearance of pleural effusion. The pneumothorax was abandoned November 18, 1947 after apparent satisfactory closure of the cavity and arrest of the disease. The sputum was converted by June 23, 1945. Re-expansion was unsatisfactory; clear fluid persisted (Figure 9).

On July 7, 1948 the fluid began turning pink. By October, 1948 it was grossly bloody and remained so. The patient became toxic, ran a fever of 101.6 degrees F. and lost four pounds. The fluid, however, was reported sterile on culture. This febrile episode subsided under a regimen of daily aspiration-irrigation and antibiotic therapy.

Decortication was done November 19, 1948, with an uneventful postoperative course and good end results with regard to obliteration of the pleural space, and clinical function (Figure 10).

Conclusions

Our experience to date leads us to advocate the operation of pulmonary decortication as the procedure of choice in selected cases of unexpandable pneumothorax. In the six cases in this category on which we have operated there have been no deaths nor unmanageable complications. In every instance there has been satisfactory and complete obliteration of the pleural space.* From a clinical standpoint, all the patients would appear to be significantly benefited. There have been no reactivations to date; further observation will obviously be necessary before final conclusions can be drawn.

SUMMARY

The historical background of decortication is briefly reviewed. The undesirable alternatives facing the phthisiologist confronted with unexpandable lung are enumerated: continued pneumothorax refills, false re-expansion, extensive thoracoplasty, space obliteration by effusion, or oleothorax. The operation of decortication is to be preferred to these in that it obliterates the pleural space and tends to restore a maximum of pulmonary function.

The early results of functional studies, some favorable and some

*At the time of presentation of this paper, November 14, 1949, there was incomplete obliteration in one case.

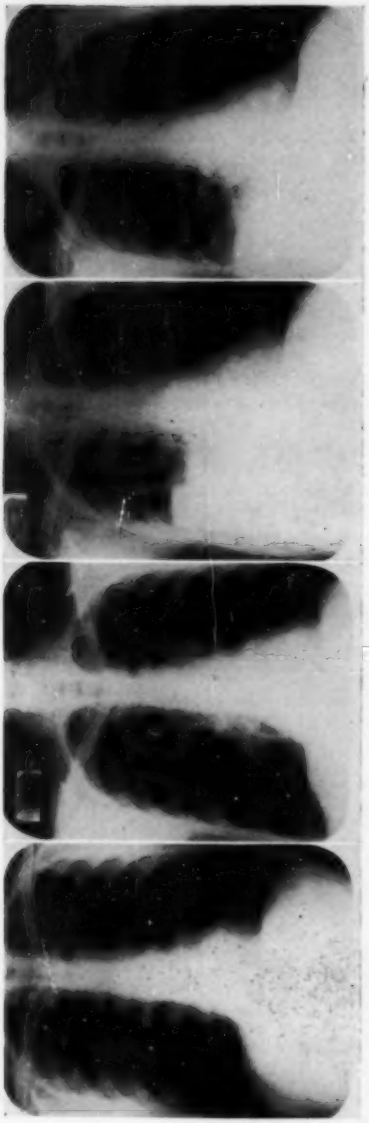

FIGURE 10

FIGURE 9

FIGURE 8

FIGURE 7

unfavorable, are reviewed, and the indications for the operation discussed. The ideal case for pneumothorax probably gives the ideal result when decorticated.

Details of operative technique which we feel to be of some importance are mentioned: a sixth intercostal space incision without rib section or resection, total removal of the parietal peel and selective removal of the visceral peel, decortication and full mobilization of the diaphragm, correction of infolding of the lung, freeing of fissures, tacking up of segments which might prolapse, avoidance of phrenic nerve injury, adequate blood replacement at operation, intratracheal cyclopropane anesthesia, active suction drainage with two catheters, postoperative bronchoscopy, and streptomycin-penicillin protection. The advantages of the Inge bone spreader in the intercostal approach are described.

The possible complications of the procedure are discussed: tension pneumothorax, subcutaneous emphysema, damage to other structures, reactivation of underlying disease, infection, bronchial block, atelectasis, prolapse, persistent bronchopleural fistula, and secondary blood loss.

The clinical results of surgery in the group reported by the authors are felt to be gratifying.

RESUMEN

La base histórica de la decorticación se revisa con brevedad.

Las alternativas que se presentan al tisiólogo con relación al pulmón inexpandible se enumeran. Tales son: continuación de las reinsuflaciones, falsa reexpansión, extensa toracoplastía, obliteración del espacio por derrame y oleotórax. La decorticación debe preferirse a todo lo anterior porque obliltera el espacio pleural y tiende a restaurar al máximo la función pulmonar.

Los resultados inmediatos del estudio funcional, alguno favorables y otros desfavorables, se revisan y se discuten las indicaciones para la operación. El caso ideal para el neumotórax, proporciona el mejor caso cuando se descortica.

Se mencionan los detalles de la técnica que se creen útiles: Incisión en el sexto espacio intercostal sin resección costal, extirpación de toda la corteza pleural cortical y selectiva de la visceral, decorticación y completa movilización del diafragma, corrección de las plegaduras del pulmón, liberación de las cisuras, fijación de los segmentos que pueden prolapsar, evitar lesionar el frénico, transfusión en volumen adecuado, anestesia intratraqueal con ciclopropano, canalización y succión activas con dos catéteres, broncoscopía postoperatoria y protección con estreptomicina-penicilina. Las ventajas que ofrece el aproximador de Inge en el cierre intercostal son descritas.

Se discuten las complicaciones posibles: Neumotórax hipertensivo, enfisema subcutáneo, daño a otras estructuras, reactivación de la afección subyacente, infección, obstrucción bronquial, atelectasia, prolapso, fistula broncopleural persistente y hemorragia secundaria.

Los resultados en el grupo relatado por los autores se cree que son satisfactorios.

RESUME

L'auteur passe en revue brièvement la base historique de la décortication pleurale.

Il énumere les alternatives qui se présentent au phtisiologue devant un poumon dont la réexpansion est difficile; ce sont: la continuation des insufflations, la mauvaise ré-expansion, la thoracoplastie étendue, l'oblitération de l'espace pleural par épanchement liquidien ou l'oléothorax. L'opération de la décortication doit être préférée à toutes les autres, parce qu'elle comble l'espace pleural et tend à restaurer au maximum la fonction rspiratoire.

L'auteur donne un apercu des résultats des examens fonctionnels, les uns favorables, les autres défavorables, et discute les indications d'opération. Le cas idéal pour pneumothorax donne probablement le résultat idéal après décortication.

Il mentionne les détails les plus importants de la technique opératoire: incision du 6ème espace intercostal, sans sectionner la côte, extirpation totale de la plévre pariétale, extirpation partielle de la plèvre viscérale, décortication, libération du diaphragme, correction des déformations pulmonaires, libération des scissures, fixation des segments qui auraient tendance à tomber, précautions pour éviter toute atteinte du nerf phrénique, transfusion de sang au cours de l'opération, anesthésie par intubation au cyclopropane, aspiration active avec deux sondes, bronchoscopie post-opératoire, protection par la streptomycine et la pénicilline associées. L'auteur décrit les avantages du pulvérisateur de Inge.

L'auteur discute les complications possibles de la méthode: hyperpression dans le pneumothorax, emphyseme sous-cutané, réveil des affections sous-jacentes, infection, obstruction bronchique, atélectasie, prolapsus, fistule bronchopleurale persistante, et hémorragie secondaire.

Les résultats cliniques de l'ensemble des observations chirurgicales rapportées sont satisfaisants.

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Discussion

Closed by

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Regarding Doctor Hobby's question on decortication for a long-standing pneumothorax with painful contraction of hemithorax and shoulder, we would think the operation definitely indicated insofar as the above signs and symptoms are concerned.

Doctor Hobby's questions with regard to the problem of how to evaluate the lung through the opaque peel, and the optimal time for operation, are of fundamental significance and will require much more laboratory study and clinical experience before the surgeon can proceed with confidence. In brief, we feel that the original pre-pneumothorax x-ray film is the most important consideration. At present we might say, however, if in doubt don't operate. We would feel that the "optimal time" would depend on many factors. Ideally we prefer the pneumothorax to have been effective for at least three or more years, with the patient asymptomatic for at least two years.

However, from a technical standpoint we are in agreement with

Doctor Harter's observation that a peel can form in a matter of weeks, and with his suggestion that the peel should be decorticated as soon as it is visualized, granted pneumothorax is to be abandoned. We have never had occasion to do an early decortication in this manner, but would not hesitate to do so.

Doctor Turner's point concerning the possibility of abandoning pneumothorax as soon as one sees trouble looming is well taken, and I'm sure reflects the policy of all here today. However, as Doctor Harter suggested, an inelastic peel occasionally forms in a surprisingly short time. In such cases it might be advisable to salvage function by immediate decortication, and then proceed with the alternative procedure, such as thoracoplasty. Doctor Turner also inquired about extrapleural stripping; we have done it on several occasions and found it satisfactory.

I was much interested in Doctor McCracken's point with respect to the feasibility of doing a small thoracoplasty first, and then a decortication. This rationale was mentioned to me by Doctor Norman Wilson yesterday, and I think it is valid. Perhaps the reverse sequence, i.e., decortication followed by thoracoplasty, would be simpler technically, but we have not had occasion to do one yet. Possibly the plasty-first regimen may prove advisable in cases of considerable involvement of the upper lobe.

Regarding Doctor Vest's question with reference to the etiology of the bloody sterile fluid, frankly we don't know. We tend to attribute the presence of the blood to un unduly high negative intrapleural pressure incidental to attempted re-expansion of the lung. The question deserves investigation.

We are grateful to Doctor Wilson for his remarks concerning Doctor Woodward's work on aureomycin. We shall make more generous use of this antibiotic in the future. Fortunately infection has not been a problem to date in our small series. Likewise we are deeply interested in Doctor Wilson's reference to Doctor Gordon's observations regarding bronchography. Any clarification of the indications for decortication is a valuable contribution.

If time permits we would like to show two slides representing unpublished data collected by Doctor Gaensler on Doctor Strieder's service, and loaned to us by Doctor Gaensler. Briefly we would call attention to the improvement in function of the decorticated lung, with special reference to ventilation and oxygen uptake, and to the continued improvement over a period of seven months. The last finding is in keeping with Doctor Gordon's observation that there is a time factor in the return to maximum function after release of the lung.

Superior Vena Caval System Obstruction

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Since the first description of superior vena caval obstruction by William Hunter[1] in 1757 there has been a progressive development of our knowledge concerning this entity. This has been accelerated in the last two decades by increasing use of venous pressure techniques and introduction of contrast media studies of blood vessels. Having found obstruction in the superior vena cava in 11 cases admitted to a general hospital during a period of approximately one year, we feel that the incidence of this syndrome is higher than is generally realized. Therefore, the clinical studies of these patients are reported to demonstrate the features of particular value in the diagnosis. Since several recent articles[2,3] have summarized the literature including historical information, incidence, etiology, and anatomy, this report will be limited to the specific cases presented at this time.

Material and Methods

In addition to the routine history and physical examination, these 11 cases were studied when possible by venous pressures, circulation times, routine x-ray inspection, infra-red photography, chest phlebograms, and necropsy. The venous pressure was measured in the antecubital veins in both arms using 10 centimeters of water above the back in recumbancy as the base line. Femoral vein pressures using the same base line were obtained when feasible. The exercise test described by Hussey[4] was used routinely. In this test the rise of venous pressure in the antecubital vein following opening and closing of the fist 30 times in one minute is noted. Phlebograms were obtained by the method of Katz, et al.,[5] using 70 per cent diodrast. In most cases the technique was modified by the simultaneous injection of 30 cc. of opaque material into each antecubital vein.

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Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the authors are the result of their own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

Discussion

Obstruction was caused by extrinsic pressure, by invasion of the vein wall by neoplasm, or by thrombosis. A combination of these factors was present in four cases (Table I).

In six cases the obstruction was caused by external pressure alone. Three of these were due to aortic aneurysm, one to a mediastinal lymphoma, one to scarring from previous mediastinitis, and one to herniation of the left lung through the mediastinum. In three cases with bronchogenic carcinoma the obstruction was caused by extrinsic pressure together with invasion of the wall of the superior vena cava. In addition, one of these cases was found at postmortem examination to have a thrombus completely occluding the superior vena cava with retrograde extension into the subclavian and jugular vessels.

TABLE I

Etiology of Superior Vena Caval System Obstruction in 11 Cases

Case	Primary Cause of Obstruction	Comment
1. A.F.	Luetic aortic aneurysm	Right side of ascending aorta.
2. W.F.	Luetic aortic aneurysm	Ascending aorta and arch
3. V.B.	Luetic aortic aneurysm	Massive aneurysm in region of aortic arch
4. E.B.	Bronchogenic carcinoma (right)	Autopsy showed extrinsic pressure, invasion of superior vena caval wall, thrombus formation
5. C.J.	Bronchogenic carcinoma (left)	Autopsy showed extrinsic pressure and invasion of superior vena caval wall
6. P.M.	Bronchogenic carcinoma (right)	Autopsy showed extrinsic pressure and invasion of superior vena caval wall
7. F.K.	Superior mediastinal lymphoma	
8. L.S.	Post mediastinitis scarring	Acute mediastinitis 50 years before at age 5, followed by venous distention and collaterals. No incapacitation. Autopsy showed complete obstruction of superior vena cava
9. C.F.	Acute mediastinal herniation of cystic lung	
10. W.G.	Thrombosis during episode of cardiac decompensation	Occlusion of right innominate vein
11. H.W.	Luetic innominate artery aneurysm	Both innominate veins occluded. Suggestive history of trauma to left side

One case was caused by thrombosis of the right innominate vein associated with an episode of cardiac decompensation. In the remaining case the obstruction resulted from pressure from an innominate artery aneurysm associated with thrombus formation. The history suggested trauma as a contributing factor in the thrombus formation.

The distribution of these causative factors corresponds well with that reported by others.[6] Herniation of a lung through the mediastinum has not been described previously as a cause of vena cava obstruction.

The symptoms presented by these patients were directly attributable to or over-shadowed by the underlying disease processes. In those cases with longstanding obstruction, no symptoms were present since adequate collateral circulation had developed.

Of these 11 cases two presented the picture of acute obstruction, complaining of dyspnea and orthopnea. Examinations revealed cyanosis, edema, and venous distention of the upper portion of the body. In both patients the signs of obstruction persisted until death which took place one week and six months after onset respectively. The remaining nine cases had a chronic course with no symptoms definitely attributable to venous obstruction. All nine presented evidence of distention of veins in the upper extremities and neck; three showed visible collateral channels.

Complete venous pressure studies (Table II) were obtained in eight cases. Seven of these showed basal venous pressure levels above 150 mm. bilaterally as well as a rise of more than 10 mm.

TABLE II

Venous Pressure Determination (millimeters of water)

Case	RIGHT ANTECUBITAL VEIN Basal	RIGHT ANTECUBITAL VEIN Exercise	LEFT ANTECUBITAL VEIN Basal	LEFT ANTECUBITAL VEIN Exercise	Femoral Vein
1. A.F.	170	202	210	228	...
2. W.F.	175	183	185	220	...
3. V.B.	290	...	290	...	175
7. F.K.	118	132	258	286	...
8. L.S.	260 288× 292+	288	255 276× 286+	272	50
9. C.F.	172	210	240	272	82
10. W.G.	110	142	65	68	...
11. H.W.	170	236	168	220	...

× = Right upper quadrant pressure.
\+ = Band around chest.

following one minute hand exercise. One case of obstruction of the right innominate vein showed a normal basal venous pressure but an abnormal response to hand exercise. In five cases variation of more than 20 mm. in the two arm pressures indicated more complete obstruction of the innominate vein on the side of the higher level. This occurred more commonly on the left due to the longer course of the left innominate vein.

Circulation times were usually prolonged but aided little in the diagnosis.

The chest phlebograms, done in seven cases, offered precise information concerning the obstruction. These demonstrated the anatomical site and degree of obstruction, the presence and distribution of collateral channels, and the retardation of venous flow in the obstructed vessels. In four cases the proximal as well as the distal margin of the obstruction was delineated. Other than the momentary discomfort immediately following the injection of the contrast media in all cases and the occurrence of chemical thrombosis in four cases no complications resulted.

The prognosis in these 11 cases depended upon the underlying disease. When the cause was a benign process and the obstruction gradual the patient, by collateral channel formation, tolerated the obstruction well. A striking example is seen in Case 8 where complete obstruction of the vena cava and azygous vein existed for 50 years with no subjective complaints. The cause of death in this patient was unrelated to the obstruction.

Case Reports

Four of the 11 cases are presented in further detail as examples of common types of obstructions.

Case 1: This man was a 59 year old Negro with a history of shortness of breath and orthopnea for 18 years. Examination revealed a large aortic aneurysm and distended cervical veins. Venous pressure levels were elevated and rose further following hand exercise. Injection of contrast media in the right antecubital and right external jugular veins revealed a complete obstruction of the right innominate vein. There was an extensive collateral network present (Fig. 1).

Comment: In this case, the slowly developing aneurysm gave ample time for the development of adequate collateral circulation around the occluded great veins. It is doubtful if any of the symptoms were caused by the venous occlusion per se.

Case 8: The patient was a 59 year old white man with a squamous cell carcinoma invading the face, which had progressed to a terminal state over a four year period. Following a severe febrile illness in childhood, large varicosities developed over the anterior chest wall and abdomen. Examination revealed, in addition to the neoplasm of the face, large tortuous veins of the chest and abdomen in which the blood flow was

from above downward. Antecubital venous pressures were elevated, showed further rise on hand exercise and also on application of a tourniquet around the mid-chest. Femoral venous pressure was normal. Phlebograms performed on two occasions revealed complete obstruction of the innominate veins and superior vena cava. Extensive collateral channels permitted blood to return to the heart by way of the inferior vena cava (Fig. 2). Postmortem examination revealed a dense fibrocalcific mediastinal mass completely obliterating the superior vena cava, both innominate veins, and the azygous vein.

FIGURE 1, Case 1: Occlusion of the right innominate vein by aortic aneurysm. Widespread collateral formation.

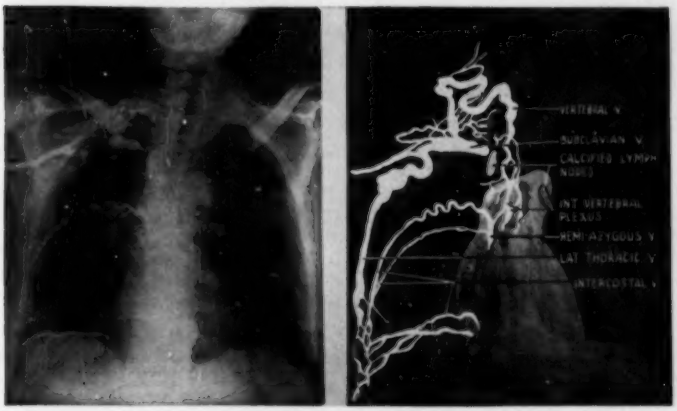

FIGURE 2, Case 8: Occlusion of the right innominate vein by a previous mediastinitis. Collateral vessels communicating with contributaries of the inferior vena cava.

Comment: This case demonstrates the typical findings where the azygous vein is involved in the obstruction. Here the subcutaneous collateral channels as well as deep venous pathways were developed to permit connection with the inferior vena cava. The remarkable adaptability of the venous system to form new channels is well demonstrated. No incapacitation resulted during 50 years of this complete obstruction.

Case 10: A 52 year old white man was admitted with a history of rheumatic fever at the age of 10 and three episodes of cardiac decompensation, the first occurring two years before admission. Examination revealed evidence of mild cardiac decompensation. In addition the arm and neck veins on the right side were more distended than on the left. After the heart had compensated, basal venous pressures were normal in both arms but there was a rise of 32 mm. on the right after hand exercise. Phlebograms demonstrated obstruction of the right innominate vein with marked collateral circulation carrying blood toward the left chest (Fig. 3).

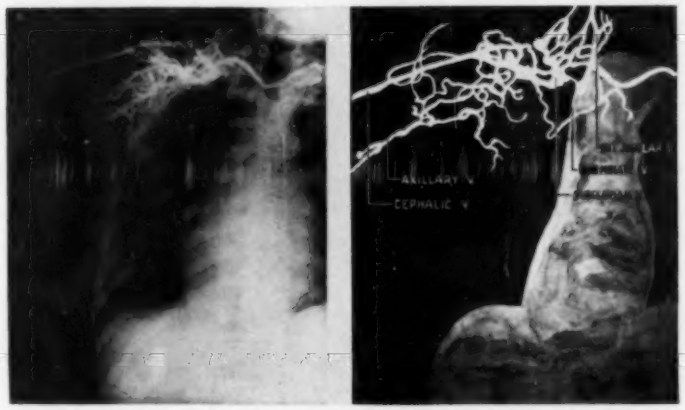

FIGURE 3, Case 10: Asymptomatic right innominate vein thrombosis secondary to an episode of cardiac decompensation.

Comment: The right innominate vein obstruction in this patient is thought due to thrombosis secondary to one of the previous bouts of cardiac failure. The diagnostic value of the hand exercise test is emphasized here for it was positive in the presence of a normal basal measurement.

Case 7: A 57 year old Negro man was admitted with an 18 month history of generalized lymphadenopathy and weight loss. Examination showed a cachectic man with generalized lymphadenopathy, splenomegaly, and distended neck veins bilaterally. Microscopic examination of a lymph node showed lymphosarcoma. Chest roentgenogram revealed a bilateral upper mediastinal mass. Venous pressures gave evidence of obstruction in both arms, being more marked on the left. Phlebograms

demonstrated complete obstruction of the left innominate vein and partial obstruction of the right innominate vein. Collateral pathways through the thyroid plexus were seen (Fig. 4).

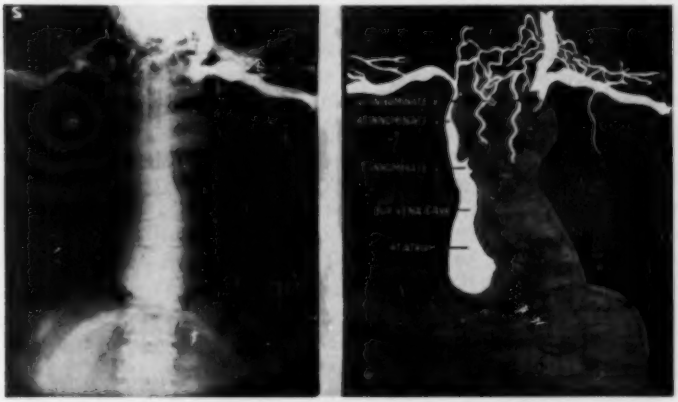

FIGURE 4, Case 7: Mediastinal lymphoma causing obstruction of the left innominate vein and compression of the right innominate vein. Venous collaterals include anterior vertebral plexus.

Comment: This case shows bilateral innominate vein obstruction caused by mediastinal lymphoma. The value of the bilateral simultaneous contrast media injection is demonstrated.

SUMMARY AND CONCLUSIONS

1) Eleven cases with superior vena caval obstruction are presented with clinical studies including venous pressures and phlebograms. We believe that the incidence of this syndrome is higher than is generally realized.

2) Since frequently there are no specific symptoms referable to the obstruction the diagnosis depends first on careful routine inspection for evidence of localized venous pressure elevation or superficial collateral vein formation. The presence of a mediastinal mass itself is indication for further study for evidence of venous abnormality.

3) The diagnosis can readily be established by the simple procedure of bilateral venous pressure determinations using especially the hand exercise technique.

4) While not necessary for the diagnosis, phlebograms often add precise information depicting the anatomical site and degree of obstruction and collateral channel formation.

5) The prognosis of superior vena caval obstruction usually depends on the primary disease. If obstruction is gradual adequate

collateral formation develops by-passing the obstruction. One case of complete obstruction remained asymptomatic for 50 years, with death occurring from another cause.

RESUMEN Y CONCLUSIONES

1) Se presentan once casos de obstrución de la vena cava superior, con estudios clinicos, incluyendo presion venosa y flebogramas. Nosotros creemos, que el porcentaje de este sindrome es mas elevado de lo que se cree generalmente.

2) Desde el momento que no hay sintomas especificos en la obstrución, el diagnóstico se basa especialmente en una prolija inspección, tratando de descubrir una elevación de la presion venosa o la formación de la circulación colateral venosa superficial. La presencia de una masa tumoral en el mediastino indica que debe buscarse evidencia en la abnormalidad venosa.

3) El diagnóstico se puede establecer simplemente por la determinación de la presion venosa bilateral, usando la técnica del ejercicio manual.

4) Aunque no son necesarios para el diagnóstico los flebogramas generalmente ayudan en la localización anatómica, el grado de obstrución y la formación de los canales colaterales.

5) El prognóstico de la obstrución de la vena cava superior, generalmente depende de la enfermedad primitiva. Si la obstrución es gradual se forma una circulación colateral adecuada alrededor de la obstrución. Un caso con obstrución completa, vivo 50 años sin ningún inconveniente, el fallecimiento fué debido a otra causa.

RESUME

1) L'auteur présente onze cas d'obstruction de la veine cave supérieure avec leurs observations cliniques qui mentionnent les pressions veineuses et les courbes des phlebogrammes. Nous croyons que l'incidence de ce syndrome est plus élevée qu'on ne croit généralement.

2) Puisque le plus souvent il n'y a pas de symptôme spécifique auquel on puisse se référer pour découvrir l'obstruction, le diagnostic dépendra d'abord de l'examen systématique qui tentera de mettre en évidence une hyperpression veineuse localisée et la formation d'une circulation collatérale veineuse superficielle. La présence d'une masse médiastinale est une indication de poursuivre les investigations pour mettre en évidence une anomalie veineuse.

3) La diagnostic peut être établi simplement par le procédé de détermination de la pression veineuse bilatérale en employant la technique de l'exercice manuel.

4) Bien qu'ils ne soient pas nécessaires pour le diagnostic, les

phlebogrammes donnent souvent des indications précises, en dépistant le siège anatomique, le degré d'obstruction et la formation d'une circulation collatérale.

5) Le pronostic de l'obstruction de la veine cave supérieure dépend généralement de l'atteinte primaire. Si l'obstruction est progressive, une circulation collatérale adéquate se forme aux alentours de l'obstruction. Un cas d'obstruction complète resta sans symptôme pendant 50 ans, avec mort survenant pour une autre cause.

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The Leukocytic Pattern During Streptomycin Treatment of Pulmonary Tuberculosis*

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One of the difficulties in the clinical evaluation of the differential count in pulmonary tuberculosis, and the cause of some of the controversial issues in its interpretation, is attributable to the chronicity of the disease process. The changes in the leukocytic pattern from one examination to the other are, as a rule, slight and their interpretation is made difficult by the fact that, in pulmonary tuberculosis, regression and progression of the disease process frequently occur simultaneously. Furthermore, relatively insignificant intercurrent diseases such as colds, which not infrequently occur during the prolonged course, are likely to add confusion in the evaluation of the changes in the hemogram. Many contradictory opinions are encountered in reviewing the very considerable literature on the subject.[1-7] An excellent summary of all the significant data in this field is that of B. E. Hall's in Myers-McKinlay, "The Chest and the Heart."

In the pre-streptomycin era, rapid changes in the pulmonary pathology occurred only in the phase of deterioration, whereas the phase of improvement—as a rule—was a slow process, and dramatic improvement could only be observed in an exceptional case. During streptomycin treatment of pulmonary tuberculosis, significant radiologic improvement occurs in certain types of pulmonary lesions within a relatively short period of time. The corresponding hematological alterations are partly caused by the drug itself, and partly by the changes in the pulmonary disease process. A specific drug effect in the blood picture is eosinophilia. It occurs in approximately 70 per cent of the cases and is thought to be an allergic phenomenon. It has no prognostic significance. In the series of 42 cases under present discussion, four patients had more than 25 per cent eosinophils in several samples of the serial examinations. One of these patients followed a clinically favorable course, whereas the three other cases displayed little or no change in pulmonary pathology or general condition.[8]

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*Reviewed in the Veterans Administration and published with the approval of the Chief Medical Director. The statements and conclusions published by the author are the result of his own study and do not necessarily reflect the opinion or policy of the Veterans Administration.

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All other alterations in the qualitative blood picture seem to be brought about by the pulmonary disease itself rather than by the drug, as they do not differ essentially from the general pattern of the hematological findings in pulmonary tuberculosis treated without streptomycin. Due to the greater rapidity of the changes in the pulmonary pathology, however, the evaluation of the corresponding hematological alterations becomes simpler.

Forty-two cases of pulmonary tuberculosis were examined by serial blood pictures. Twenty-five of these were far advanced, and 17 moderately advanced at the time treatment was started; in the disease process of each of these cases, the exudative element was predominant. Eight patients received 2 grams of streptomycin daily for 120 days, 15 1 gram daily for 120 days, and 19 1 gram daily for 42 days. Examination of the blood preceded streptomycin treatment by a period of three to 10 weeks, and was continued until four months following completion of the course. Altogether 867 blood films were examined; two slides were stained in each examination, one with Wright's stain and the other with a specially buffered Giemsa solution to demonstrate toxic granulation.[9] In addition to the routine differential counts, a special qualitative analysis of the neutrophils (Arneth) was made in all those cases where no shift to the left was noted. All smears and counts were made by the same examiner (author) to assure uniform technique.

Improvement was indicated by (1) diminishing shift to the left; this, however, was not very often expressed in the band cell/segmented cell relation but only in the degree of segmentation; (2) decreased degree of toxic granulation; (3) return of the previously low lymphocyte count to the normal; an increase in the number of lymphocytes, however, proved to be a favorable sign only if it occurred simultaneously with subsidence of shift to the left of the neutrophils.

Monocytosis, by itself, did not indicate an unfavorable prognosis. It was an unfavorable sign, and suggestive of new tubercle formation, only if it occurred simultaneously with lymphopenia and a shift to the left of the neutrophils.

Eosinophilia, as has been said, is an allergic phenomenon. In seven cases of this series, a sudden increase of the eosinophils to above 12 per cent occurred almost simultaneously with the development of bacterial resistance; whether the relationship of these two phenomena was causal or merely coincidental, cannot be stated.

In the majority of the cases, clinical and radiologic changes for the better or worse corresponded with alterations in the qualitative leukocyte picture. The fact that, in the majority of the cases, the hematological changes preceded the corresponding

clinical and radiologic changes by a short period of time, not exceeding a few days or weeks, is not believed to be of any practical value. Neither is particular importance attributed to the observation that the blood picture did not show favorable changes in those cases where there was symptomatic, but no radiographic improvement. More valuable information was obtained from the study of the qualitative white blood cell picture in those cases where there was discrepancy between the radiographic and hematological findings. There were cases (Chart I) showing clinical and radiologic improvement with no favorable changes in the blood picture, or with increase in the number of lymphocytes but no change in the shift to the left of the neutrophils and in toxic

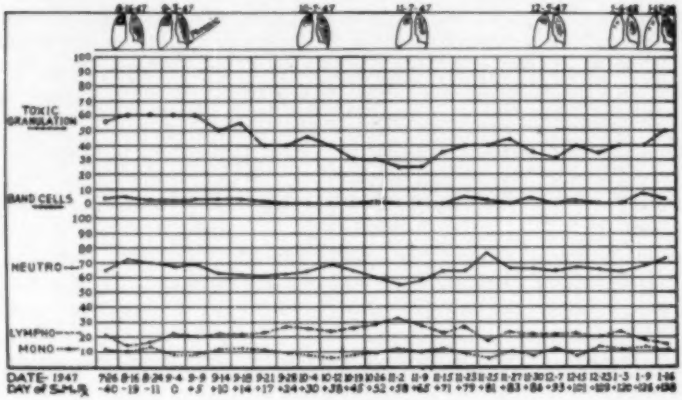

CHART 1

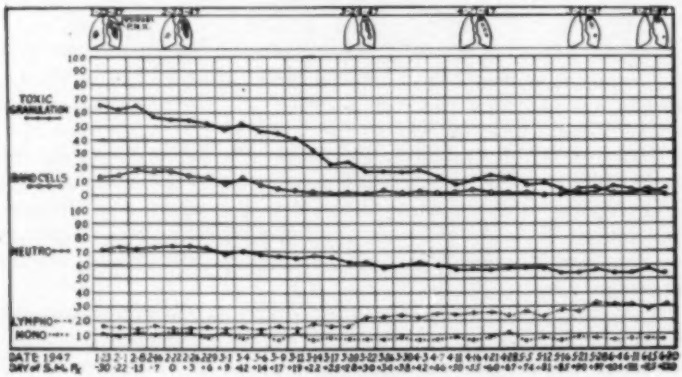

CHART 2

granulation; in these cases, early relapse occurred and the ultimate results of streptomycin treatment were poor, or a simultaneous, previously unrecognized extrapulmonary focus was present that did not respond to streptomycin. Unfavorable radiologic changes (shelling out of a new cavity in one case, a new caseous focus in another) if not accompanied by changes for the worse in the blood picture—proved to be temporary, and the final result of the streptomycin treatment was good (Chart II). In the latter cases, previously unnoted foci probably were already present prior to the streptomycin treatment, but had not reached sufficient density for visualization at that particular time. A representative case of each of these two groups is presented.

D.G.R., a 31 year old white male, had a large subapical cavity on the left side with recent spread to the right upper lobe and subsequent cavitation. This is a case of prompt favorable clinical and radiologic response to streptomycin, followed by early relapse. During streptomycin therapy, at the point of maximal clinical and radiographic improvement, 25 per cent of the neutrophils still had toxic granulation, in spite of an increase in the number of lymphocytes from 16 to 31 per cent. Approaching the end of the course, the x-ray still looked favorable and the number of lymphocytes was still within normal limits (22 per cent), but 40 per cent of the neutrophils showed toxic granulation. There was no increase of the band cells, but the number of the nuclear lobules was decreased (shift to the left according to Arneth). The conclusion can be drawn that a return of the number of lymphocytes to normal without corresponding changes in the neutrophils, cannot be considered a favorable prognostic sign.

K.D.S., a 24 year old white male, had exudative infiltration throughout the upper two-thirds of the left lung with a large apical cavity. There was a small amount of exudative spread to the right mid-lung field. This is a case which showed an initially poor, but subsequently favorable radiologic and clinical response to streptomycin. During the first month of treatment, there was no improvement manifested by x-ray examination and a new cavity in the left mid-lung field was noted. There was, however, a prompt favorable response in the hemogram, its first manifestation being a diminished number of neutrophils with toxic granulation. The prognosis appears to be favorable if there is no dissociation in the reaction of the three different groups of white blood cells, but if each of them shows uniform improvement.

Discrepancy between the radiographic and hematological findings was present in five cases, including the above two. In 37 patients, the leukocytic pattern was just a confirmation of the radiologic findings. Among these, in nine cases with poor results of the streptomycin therapy, the pre-existing neutrophilia and monocytosis persisted or slightly increased during treatment. In 10 cases, the results of therapy were excellent, and in 18, slight or moderate. Among these, as a rule, decreased degree of toxic

granulation was the first corresponding favorable hematological sign, followed by an approximately simultaneous decrease in the number of monocytes and increase in the number of lymphocytes. There were, however, several cases in this group which did not follow the same pattern.

O.W., a 53 year old white male, had caseo-cavernous disease in the right upper lobe with recent exacerbation and spread to the left mid-lung field. Endobronchial tuberculosis was suspected (beyond bronchoscopical visualization) and tuberculous laryngitis was present. There was rapid improvement of the laryngitis and clearing of the infiltrations with subsequent cavity closure on 1 gram streptomycin daily from October 2, 1947 to February 2, 1948. In the pre-streptomycin blood pictures toxic granulation was present in 15 per cent of the neutrophils; there was relative lymphopenia (below 18 per cent), and slight monocytosis (not exceeding 11 per cent). The toxic granulation disappeared on the sixth day of treatment. At the same time, the number of both lymphocytes and monocytes started to increase. This persisted throughout the first 90 days of the therapy; the number of lymphocytes was between 26 and 38 per cent, that of the monocytes, between 11 and 17 per cent. Subsequently, the monocytosis subsided, whereas the number of lymphocytes remained high. Conclusion: Monocytosis does occur in the stage of retrogression of tuberculous lesions, and is not an unfavorable sign, if, at the same time, lymphocytosis and shift to the right of the neutrophils are present.

L.R.D., a 30 year old white male, had caseous pneumonic disease involving the right lung except the extreme apex and caseous-nodular spread to the left mid-lung field. He was acutely sick, but his pulmonary pathology responded promptly to a 42 day course of streptomycin (1 gram daily from August 4, 1948 to September 15, 1948). On August 3, 1948 there was shift to the left (four metamyelocytes, 22 band cells), toxic granulation in approximately 60 per cent of the neutrophils, lymphopenia and monocytosis. After the first 10 days of therapy, the shift to the left and toxic granulation of the neutrophils practically disappeared. The low number of lymphocytes (8 per cent) did not increase to above 15 per cent for the first 30 days of therapy, whereas the initial monocytosis (14 per cent) persisted at a high level (13 to 18 per cent) during this period of time. Conclusion: Even a reversal of the lymphocyte/monocyte ratio does not necessarily constitute a poor prognostic sign if simultaneously there is subsidence of shift to the left of the neutrophils and disappearance of toxic granulation.

SUMMARY

1) A study of the leukocytic pattern during streptomycin treatment of pulmonary tuberculosis on 867 blood films of 42 patients is presented.

2) During the treatment of pulmonary tuberculosis with streptomycin, the alterations in the blood picture are due to changes in the disease process, except for the frequently observed eosinophilia, which is a specific drug effect. The rapidity of these

changes in many cases facilitates observation of the corresponding alterations in the leukocytic pattern.

3) In this study, the more or less generally accepted view that lymphocytosis is a favorable, and monocytosis an unfavorable, sign was found to be true with the following modifications: (a) Lymphocytosis, or more correctly, the return of the previously low lymphocyte count to normal or hypernormal, is a favorable sign only if it is accompanied by subsidence of shift to the left and diminished toxic granulation of the neutrophils. (b) Monocytosis per se is not an unfavorable sign, unless it is accompanied by a shift to the left of the neutrophils and by lymphopenia. In tuberculosis, a shift to the left of the neutrophils is not always manifested in the band cell/segmented cell relation; in many cases, one has to resort to the more time-consuming examination of the degree of segmentation (Arneth count).

4) The serial examination of the leukocytic pattern during streptomycin treatment has very limited practical value because (a) streptomycin is not considered definitive therapy in the large majority of the cases, and because (b) radiologic examination is the only adequate means of following the effect on the disease process; the hematological findings are merely confirmatory of x-ray in most of the cases. Only in the rare instance, where there is a discrepancy between the radiographic and hematological findings, are the latter of some prognostic significance.

RESUMEN

1) Se presenta un estudio de los tipos de leucocitosis en 867 placas en 42 casos durante el tratamiento con estreptomicina para la tuberculosis pulmonar.

2) Los cambios en la fórmula sanguinia durante el tratamiento con estreptomicina en la tuberculosis pulmonar, son debidos a cambios de la enfermedad, excepto en el caso frecuente de la eosinofilia, la cual es un efecto especifico de la droga. La rapidez de esos cambios en muchos casos, facilita la observación de los cambios en la fórmula leucocitaria.

3) La teoria de que la linfocitosis es favorable y la monocitosis no es favorable ha sido provada en este trabajo con las siguientes modificaciones: (a) La linfocitosis, o mas correctamente la vuelta a lo normal del recuento de los linfocitos, es un signo favorable, unicamente en e lcaso de una desviación hacia la izquierda y una desminución de la granulación tóxica de als neutrofilos. (b) La monocitosis per se, no es un signo desfavorable al menos que sea acompañada por una desviación a la izquierda de las neutrofilos y linfopenia. En la tuberculosis, la desviación hacia la izquierda de las neutrofilos, no se manifiesta siempre por la relación entre

las bandas de los celulas y los segmentos de la celula. En muchos casos tiene que recurrir al procedimiento lento de examinar el grado de segmentación (tecnica de Arneth).

4) El exámen seriado de los tipos de leucocitos durante el tratamiento con estreptomicina tiene un valor práctico muy limitado; porque la estreptomicina no es considerado como un factor terapéutico definitivo, en la gran mayoria de los casos y también porque el exámen radiológico es el único medio de seguir la evolución de la enfermedad. El resultado hematológico, solamente confirme el estudio radiológico en la mayoria de los casos. Solamente in casos raros, cuando hay una discrepancia entre el exámen radiológico y hematológico este último tiene una valor pronóstico.

RESUME

1) L'auteur présente une étude de la formule leucocytaire d'après 867 lames réalisées sur 42 malades pendant un traitement a la streptomycine contre la tuberculose pulmonaire.

2) Pendant le traitement de la tuberculose pulmonaire par la streptomycine, les modifications dans la formule sanguine sont dues à l'évolution de la maladie, sauf en ce qui concerne le cas fréquent de l'éosinophilie que est un effet spécifique de la drogue. La rapidité de ces modifications dans beaucoup de cas facilite l'observation des modifications correspondantes dans la formule leucocytaire.

3) Dans cette étude, la théorie plus ou moins acceptée selon laquelle la lymphocytose est favorable et la monocytose défavorable s'est révélée exacte avec les modifications suivantes: (a) la lymphocytose, ou mieux le retour à la normale du nombre des lymphocytes est un signe favorable, uniquement dans le cas d'une déviation vers la gauche, et d'une diminution des granulations toxiques des neutrophiles. (b) La monocytose en elle-meme n'est pas un signe défavorable à moins qu'elle ne soit accompagnée d'un glissement vers la gauche des neutrophiles et de lymphopénie. Dans la tuberculose, un glissement vers la gauche des neutrophiles ne se manifeste pas toujours dans la relation entre les cellules segmentées et l'ensemble des autres cellules; dans beaucoup de cas, il faut recourir au procédé plus lent de l'examen du degré de segmentation (méthode d'Arneth).

4) L'examen en séries de la formules leucocytaire pendant le traitement à la streptomycine a une valeur pratique très limitée: (a) parce que la streptomycine n'est pas considérée comme un facteur thérapeutique définitif dans la majorité des cas, (b) parce que l'examen radiologique est le seul moyen de suivre l'évolution de la maladie; les constatations hématologiques confirment l'étude radiologique dans la plupart des cas; toutefois dans quelques rares

exemples, lorsqu'il y a discordance entre les constations radiologiques et hématologiques, ces dernières ont une certaine valeur pronostique.

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The Effect of Pneumoperitoneum on the Electrocardiogram*

A Study of the Results Obtained with Standard and Unipolar Leads

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I. *Introduction.*

The effects of pneumoperitoneum on the electrocardiogram have been studied previously, and the literature reflects a difference of opinion.

The earliest report is that of Agnello,[1] who studied 20 patients with pneumoperitoneum, of whom seven had had a previous diaphragmatic paralysis, and another eight had had a pneumothorax, either unilateral or bilateral. He took electrocardiograms in the recumbent position, and repeated some of them with the patients sitting. He found that the insufflation of 300 cc. of oxygen into the peritoneal cavity produced a left axis shift in nearly every case, accompanied by an increase in the height of R_1 and R_2, and an increase in the depth of S_2 and S_3. With the patients in the sitting position, the tracings were unsatisfactory. Agnello's study is an extremely valuable one, but not strictly comparable to the other work on the subject inasmuch as immediate changes only were studied (after the insufflation with gas), and only 300 cc. of oxygen were introduced into the peritoneal cavity which is less by several hundred cc. or more than the routine presently employed.

The study of this subject was repeated by Elwood, Piltz and Potter,[2] who did electrocardiograms on 20 cases of pneumoperitoneum, on 10 of whom tracings had been obtained prior to the induction of pneumoperitoneum. They found that the electrocardiograms of these 20 patients presented a left axis shift in eight, a deep Q_3 in six, an inverted T_3 in 17, and an isoelectric T_3 in one. They further showed that the addition of right phrenicectomy tended to produce a diminution in the number and degree of abnormal changes, while in one of two cases of left phrenicectomy, they were intensified. Finally they demonstrated that the abnormal changes were reversible, and tended to disappear when the air was resorbed from the peritoneal cavity.

The third study of this subject was carried out by Benatt and

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Berg,[3] who made simultaneous studies of the electrocardiogram and the x-ray position of the heart in patients receiving pneumoperitoneum. They selected five patients receiving pneumoperitoneum (all of whom had previously had phrenic crush) and made repeated studies on them before, and during the early weeks after the initiation of therapy. They estimated the position of the electrical axis, basing their calculations on the vector analysis methods of Ashman and co-workers,[4-6] and then they compared their results with the position of the anatomical axis as determined from the x-ray. They pointed out (in contrast to the findings of Ashman et al.[5,6] in normal hearts normally situated) that a marked discrepancy existed between the two in patients with pneumoperitoneum. Although only five cases were studied, the careful and repeated nature of such observations makes this a valuable contribution to the subject. The following changes were observed: The development of a conspicuous Q_3, small R_3 and a negative T_3. The RS-T segment in Lead II was also flattened. The only variation was in the extent of these changes, and they were apparently independent of whether the right, or the left side of the diaphragm was elevated. Following abandonment of the pneumoperitoneum, the tracings reverted toward what had been present before. Calix and Jacobs[7] found similar results, using a similar type of analysis.

A fifth study, by Evans and Black[8] is the most recent. In this instance unipolar chest, extremity and esophageal leads were taken for the first time, in addition to standard extremity leads. Ten patients were studied, four with a left phrenemphraxis, three with a right, and three with no phrenic nerve operation. The precordial and extremity leads were taken in the recumbent position, while the esophageal leads were taken in both the sitting and recumbent positions. It was found that pneumoperitoneum produced definite axis deviation in only one case. Abnormally large Q waves were produced in the extremity leads (in Leads II, III and aVF) in only one case, while in another instance previously abnormally large Q waves in aVl were diminished in size. In contrast to these findings the esophageal leads revealed abnormally large Q waves in all 10 cases. These writers also found that the heart's position by x-ray was displaced upward and forward in all 10 patients.

Since many persons with pneumoperitoneum have a paralyzed hemidiaphragm as well, it is important to realize what effect this by itself has on the electrocardiogram. Many studies have been done, and the consensus[9-11] seems to be that while QRS changes frequently occur, they are neither striking nor consistent. Axis deviations cannot be correlated with the observed position of the heart. T wave changes are also frequently noticed.

II. *Materials and Methods.*

Nineteen unselected tuberculous patients receiving pneumoperitoneum at Trudeau Sanatorium were studied. Eleven had moderately advanced, and eight far advanced disease. All but one, had a cavity. The extent and location of disease, and the indication for pneumoperitoneum varied widely from patient to patient. None of the patients had definite subjective or objective evidence of heart disease, although several complained of dyspnea and palpitations. Since symptoms of this nature are common in tuberculous patients, especially in the presence of collapse therapy,[12] they were not considered evidence of heart disease. Three of the 19 patients may be considered as having possible heart disease, however. One developed palpitations and ankle edema during a pregnancy immediately prior to the discovery of far advanced tuberculosis. Evidence at that time at another institution showed no cardiac abnormalities, but the symptoms were apparently considered of cardiac origin anyway. The symptoms disappeared after delivery. On admission to Trudeau Sanatorium, shortly thereafter, the patient was found to have a moderately loud M_1 in the left lateral recumbent position. Another patient had an unusually prominent pulmonary conus prior to the institution of collapse therapy. No murmurs or abnormal heart sounds were present. A third patient had a blood pressure of 160/90.

The patients were grouped according to whether they had had a phrenic nerve operation in addition to the pneumoperitoneum. Eight had had right phrenic interruption and three had had left phrenic interruption. The eight remaining patients had not had such a procedure. All but one of the patients who had been operated upon, had had a phrenic crush performed. One patient, however, had an avulsion years before admission to Trudeau Sanatorium.

The patients were first placed in the recumbent position. Three standard limb leads, the CF leads (CF_1 through CF_3), the three augmented unipolar limb leads, and the V leads (V_1 through V_6) were taken on all patients. A Wilson assembly with a 5,000 ohms resistance between the central terminal and each extremity electrode was used in taking the augmented unipolar limb leads as well as the V leads.* The patient was asked to inspire deeply while

*The Wilson central terminal was constructed for us according to the instructions given by Ethridge and Stolar,[24] by Mr. Ed. Worthington of Saranac Lake. This was attached as directed in Ethridge and Stolar's paper, the only difference being that a Sanborn Cardiette (a vacuum tube amplifier with a photographic recording device) was used instead of a string galvonometer. In order to prevent the appearance of excessive electrical interference the unused lead of the Cardiette had to be grounded (to the patient's leg).

Leads III and aVf were being recorded. The patient was then immediately placed in the sitting position, and more tracings were made. In this position the extremity leads, both standard and unipolar, and CF_4 and V_4 were taken. In a few cases CF_5, CF_6, V_5 and V_6 were also taken with the patient sitting. The patient was again asked to inspire deeply while Leads III and aVf were being recorded.

III. *Interpretation of the Records Obtained.*

The records obtained were studied in the usual fashion. The rate and rhythm were carefully described, the P-R interval and QRS duration measured, and the P, QRS, T and U deflections were described in every case.

The next step in the procedure was to estimate the position of the heart from the electrocardiogram, when the patient was first in the recumbent, and second in the sitting position. This was done by analyzing the respective tracings. The standard lead electrocardiograms were read according to Katz's[13] interpretation, and the unipolar lead electrocardiograms were read according to Wilson's[14] interpretation. (As previously stated, a Wilson assembly was used in taking the augmented unipolar limb leads, since at the time the study was done, both Goldberger[15] and Wilson[14] were in apparent agreement that records obtained in this fashion were apparently indistinguishable from those obtained by Goldberger's[15] technique. More recently, however, Bryant, Johnston and Wilson[16] and Rappaport and Williams[17] have reported evidence that the introduction of the Wilson assembly causes changes in both the form and amplitude of the deflections obtained. While both the frequency and magnitude of the discrepancies between the two techniques observed by Bryant, Johnston and Wilson were small, it was decided for this reason to follow Wilson's rather than Goldberger's analysis of the tracings obtained).

The third step in the procedure was to compare the electrocardiograms obtained with the patient in the two positions with each other, to see whether significant changes were introduced by a change in the patient's posture. The fourth step was to observe the effects of deep and quiet respiration on the electrocardiograms. Finally the information about the heart's position obtained from the standard lead electrocardiogram was compared with that obtained from the unipolar lead electrocardiogram.

Throughout the entire study, great attention was paid to the definition of "important differences" in studying the changes produced in the electrocardiogram by changes in posture or respiration. The writer feels that minor changes between one electrocardiogram and another taken within a few minutes on the

same patient can easily be overstressed; and that such variations are either artefacts, errors of interpretation, or expressions of the variability inherent in biological material. This is especially true as tracings in the sitting position are apt to show somatic tremor. For these reasons changes were not considered significant unless they conformed to either one of the following rigid criteria:

1) Difference in amplitude had to be both larger than 2 mm., and at least 50 per cent larger than the amplitude of the smaller deviation. In other words, if an R wave in the recumbent position was plus 10 mm. in height, then that in the sitting position had to be either equal to or larger than plus 15 mm. (more than 50 per cent greater); or equal to or less than plus 6.5 mm. (less by 50 per cent of the smaller deflection) if the difference was to be considered important. On the other hand a P wave of plus 2 mm. would not be considered as demonstrating an important difference if it changed to one of plus 1 mm. in size, as the total change would be less than 2 mm. (even though at the same time it is 100 per cent of the smaller deflection). In the case of the augmented unipolar extremity leads, the magnitude of whose deflections is exaggerated by 50 per cent, in the process of recording them, these differences were required to be at least 3 mm. instead of 2 mm. in order to be considered important. Although positive deflections were used for the above illustration, precisely the same standards, of course, were applied to negative deflections.

2) Consistent differences in direction of a deflection were considered important regardless of the total magnitude of the changes involved.

IV. *Results.*

A. *Standard Lead Electrocardiogram: (1) Recumbent Position (Table I).*

The standard lead electrocardiogram, in the recumbent position produced an essentially normal pattern with a vertical axis. In brief, Katz[13] defines a vertical axis as a tracing in which both QRS_1 and QRS_2 are directed upward, and in which QRS_2 is the larger. If QRS_1 is the larger it is considered to show left axis deviation. Our findings were that all eight patients without a phrenic crush, six of the eight patients with a right phrenic crush, and two of the three with a left phrenic crush, had an electrocardiogram characterized by upright QRS complexes in Leads I and II, with that in Lead II the larger. There were only three patients who showed a left axis deviation. Perhaps by coincidence, all three were men although there were only seven men in the whole series. One of them was the only patient with a borderline

TABLE I: The Standard Lead Electrocardiogram in the Recumbent Position.

Lead	QRS Usual Pattern	QRS Unusual Pattern	AXIS Vertical	AXIS Left	T WAVES Upright	T WAVES Indistinguishable	T WAVES Polyphasic	T WAVES Inverted
A. Without Phrenic Crush (8 cases):								
I	8	0			8	0	0	0
II	8	0	8	0	8	0	0	0
III	6	Deep Q3=1 Deep S3=1			7	0	0	1
CF Leads	7	R′ waves in CF1−CF5=1			CF3−CF6=6 CF4−CF6=1 CF5−CF6=1	0	CF3=1 CF4=1	CF3=1
B. With Right Phrenic Crush (8 cases):								
I	6	Deep S1=2			8	0	0	0
II	8	0	6	2	8	0	0	0
III	6	Deep S3=2			4	0	3	1
CF Leads	8	0			CF3−CF6=6 CF4−CF6=1 CF5−CF6=1	0	CF3=2 CF4=1	0
C. With Left Phrenic Crush (3 cases):								
I	3	0			3	0	0	0
II	3	0	2	1	3	0	0	0
III	2	Deep S3=1			2	0	0	1
CF Leads	3	0			CF3−CF6=3	0	0	0
D. Total (19 cases):								
I	17	Deep S1=2			19	0	0	0
II	19	0	16	3	19	0	0	0
III	14	Deep S3=4 Deep Q3=1			13	0	3	3
CF Leads	18	R′ waves in CF1−CF5=1			CF3−CF6=15 CF4−CF6= 2 CF5−CF6= 2	0	CF3=3 CF4=2	CF3=1

TABLE II: The Standard Lead Electrocardiogram in the Sitting Position

Lead	QRS: Times Omitted	QRS: Usual Pattern	QRS: Unusual Pattern	AXIS*: Vertical	AXIS*: Left	T WAVES: Upright	T WAVES: Indistinguishable	T WAVES: Polyphasic	T WAVES: Inverted
A. Without Phrenic Crush (8 cases):									
I	0	8	0			7	0	0	1
II	1	7	0	7	0	0	0	3	4
III	0	2	Deep S3=4 Deep Q3=2			1	2	0	5
B. With Right Phrenic Crush (8 cases):									
I	0	6	Deep S1=2			8	0	0	0
II	2	6	0	5	1	0	0	1	5
III	0	3	Deep S3=3 Deep Q3=2			0	0	2	6
C. With Left Phrenic Crush (3 cases):									
I	0	3	0			3	0	0	0
II	0	3	3	2	1	0	0	0	3
III	0	0	Deep S3=3			1	0	0	2
D. Total (19 cases):									
I	0	17	Deep S1=2			18	0	0	1
II	3	16	0	14	2	0	0	4	12
III	0	5	Deep S3=10 Deep Q3= 4			2	2	2	13

*The axis could not be determined in those 3 cases in which Lead II was not recorded.

hypertension. One case only showed a deep Q_3, and no abnormal Q waves were noticed in any other lead in any tracing. Four patients, three of whom had right phrenic crush, did not have an upright QRS in CF_5; in three cases it was definitely inverted, and in the fourth it was variable. The only clearly abnormal findings were the presence of polyphasic T waves in CF_4. These were noted in two cases. An inverted T_3 was present in three, and a polyphasic T_3 was noticed in another three.

B. *Standard Lead Electrocardiogram: (2) Sitting Position (Table II).*

With the patients in the sitting position various technical difficulties arose. It was found, as Agnello[1] previously observed, that placing patients with pneumoperitoneum in the sitting position produced bad records owing to the presence of somatic tremor. (This was occasionally marked enough so that it was hard to tell whether an S wave or a Q wave were present. Where the slightest doubt existed, such deflections were always read as an S wave). It was also found that when the patient was in the sitting position, the whole shape of the rib cage and the relation of the heart to the ribs changed to such an extent that it was impossible to take the precordial leads from the identical precordial positions used when the patient was supine. For this reason no attempt was made to compare the CF leads taken with the patient in the recumbent and sitting positions. It was felt that any observed differences could be due to an unavoidable variation in locating the precordial electrode. Therefore attention is confined to the limb leads in the discussion that follows.

In the sitting position a far different electrocardiographic picture was presented, even when the limb leads alone were studied. In three cases no Lead II was taken so that they are excluded from the following discussion. In 12 of the remaining 16 cases, evidence of left axis shift was present. These consisted of four of seven cases without phrenic crush, five of six with a crushed right phrenic nerve, and all three with the phrenic crushed on the left side. Since three of these cases had already had a left axis shift while in the recumbent position, it follows that the patients simply rising from the recumbent to the sitting position had caused the appearance of a definite left axis shift in nine of 16 cases. In all but two of them the appearance of the left axis shift was accompanied by an important increase in the height of QRS_1, and an important decrease in the height of QRS_2. The term "important" in the preceding sentence is to be interpreted according to the very rigorous definition supplied earlier in the paper; implying a change of at least 50 per cent of the size of the smaller

TABLE III: The Unipolar Lead Electrocardiogram in the Recumbent Position

Lead	QRS — Usual Pattern	QRS — Unusual Pattern	POSITION OF HEART — Semi-Vertical	Inter-mediate	Semi-Horizontal	Indeter-minate	T WAVES — Upright	Indistin-guishable	Poly-phasic	Inverted
A. Without Phrenic Crush (8 cases):										
aVr	rS = 6	rSr' = 2					0	0	0	8
aV1	No predominate pattern		4	2	0	2	6	1	0	1
aVf	qR = 5	qRs = 3					7	0	1	0
V Leads	No predominate pattern						V3 — V6 = 7 V5 — V6 = 1	0	0	V3 — V4 = 1
B. With Right Phrenic Crush (8 cases):										
aVr	rS = 2	rSr' = 5 Small Defl.* = 1					0	0	0	8
aV1	No predominate pattern		1	0	2	5	8	0	0	0
aVf	qR = 4	qRs = 1 Small Defl.* = 3					8	0	0	0
V Leads	No predominate pattern						V3 — V6 = 7 V5 — V6 = 1	0	V3 — V4 = 1	0
C. With Left Phrenic Crush (3 cases):										
aVr	rS = 3	0					0	0	0	3
aV1	No predominate pattern		0	1	0	2	3	0	0	0
aVf	qR = 3	0					3	0	0	0
V Leads	No predominate pattern						V3 — V6 = 3	0	0	0
D. Total (19 cases):										
aVr	rS = 11	rSr' = 7 Small Defl.* = 1					0	0	0	19
aV1	No predominate pattern		5	3	2	9	17	1	0	1
aVf	qR = 12	qRs = 4 Small Defl.* = 3					18	0	1	0
V Leads	No predominate pattern						V3 — V6 = 17 V5 — V6 = 2	0	V3 — V4 = 1	V3 — V4 = 1

*A small deflection is one whose total amplitude is equal to or less than 3 mm.

deflection and at least 2 mm. in magnitude. The increase in the size of QRS_1 of course was due to the increase in height of R_1, while the decrease in QRS_3 was due to any one of three mechanisms, namely, either to an important decrease in R_3 or to an important increase in either Q_3 or S_3.

One patient developed a typical "heart strain" pattern with large QRS deflections and inversion of T_1. His tracing in the recumbent position had been perfectly normal.

In all 19 cases Lead III (as well as Lead I) was taken in the sitting position. The findings are of interest in that four developed a deep Q_3. Curiously enough, this did not include the patient in whom a deep Q_3 was present when she was recumbent. Furthermore 13 of the 19 patients had an inverted T_3, two more had an indistinguishable T_3, two had a diphasic T_3 and only two had an upright T_3.

C. *Unipolar Lead Electrocardiogram: (1) Recumbent Position (Table III).*

The unipolar lead electrocardiogram in the recumbent position also revealed an essentially normal picture. Wilson's[14] classification of the heart's position is based on comparing the patterns in the unipolar limb leads with those observed in the V leads. His classification was followed with the utmost exactitude as far as the QRS complexes were concerned. In making this comparison any QRS complex whose greatest deflection was less than 3 mm. in amplitude, was considered as being "small" in Wilson's sense of the term. No attention was paid to the direction of the T waves as various investigators[18] are in agreement with our own observation that abnormal T waves are a common occurrence in tuberculous patients undergoing collapse therapy. (This point is discussed in detail further on in this presentation). Because of the strictness with which the comparison between augmented unipolar leads and V leads was made, in nine of the 19 cases, the heart's position had to be classified as "indeterminate," i.e., it could not be classified. On the remaining 10, however, five were semivertical, three were intermediate, and two were semihorizontal.

No predominate electrocardiographic pattern emerged. Almost all tracings had an inverted QRS in aVr and an upright complex in aVf. A variety of patterns were seen in aVl. One patient had upright QRS complexes in V_1 and V_2. Goldberger and Schwartz[19] consider this evidence of right ventricular hypertrophy. Since this patient had far advanced pulmonary tuberculosis of long standing, and a rightsided thoracoplasty, he was the only one in the entire series in whom there was a reasonable clinical possibility of right ventricular hypertrophy. This same patient also showed an inverted

TABLE IV: The Unipolar Lead Electrocardiogram in the Sitting Position

Lead	Times Omitted	QRS — Usual Pattern	QRS — Unusual Pattern	POSITION OF HEART* — Semi-Vertical	POSITION OF HEART* — Intermediate	POSITION OF HEART* — Semi-Horizontal	POSITION OF HEART* — Indeterminate	T WAVES — Upright	T WAVES — Indistinguishable	T WAVES — Polyphasic	T WAVES — Inverted
A. Without Phrenic Crush (8 cases)											
aVr	0	rS=6	rSr'=2					1	0	0	7
aV1	1	No predominate pattern		0	2	0	5	6	0	0	1
aVf	0	No predominate pattern						4	1	0	3
B. With Right Phrenic Crush (8 cases):											
			QR=1								
aVr	0	rS=2	rSr'=5					0	0	0	8
aV1	2	No predominate pattern		1	0	3	2	6	0	0	0
aVf	0	No predominate pattern						3	3	0	2
C. With Left Phrenic Crush (3 cases):											
aVr	0	rS=3	0					0	0	0	3
aV1	3	No predominate pattern		0	0	2	1	3	0	0	0
aVf	0	No predominate pattern						1	0	0	2
D. Total (19 cases):											
			rSr'=7								
aVr	0	rS=11	QR=1					1	0	0	18
aV1	3	No predominate pattern		1	2	5	8	15	0	0	1
aVf	0	No predominate pattern						8	4	0	7

*The position of the heart could not be determined in those 3 cases in which Lead aVl was not recorded.

T in aVl. One other had an indistinguishable T wave in this lead, and a third had a biphasic T in aVf.

D. *Unipolar Lead Electrocardiogram: (2) Sitting Position (Table IV).*

The electrocardiogram in the sitting position showed the same technical difficulties observed with the standard leads, and consequently the tracings were again read as conservatively as possible. In the same three cases as before in which no Lead II had been taken, no aVl was taken either, and these are not further considered, leaving 16 cases completely studied.

The patterns observed in the limb leads were compared with those present in the V leads previously taken in the supine position, however, rather than those taken in the sitting position. This was done on the theory that only in the recumbent position could one be sure that the leads taken from the right side of the precordium faced the right ventricle, and those taken from the left side faced the left ventricle.

Eight electrocardiograms showed an indeterminate position, one semivertical, two intermediate and five semihorizontal. Comparison between the sitting and recumbent positions showed that in four cases the heart had shifted from one of Wilson's positions to another more horizontal. In two no change occurred. In the remaining 10 cases this shift could not be read as the heart's position was indeterminant either with the patient recumbent or sitting or both. In spite of this fact, however, there was clear cut evidence of a horizontal shift of the axis in five of these remaining 10 cases. This evidence consisted of a combination of an important increase in the height of the R wave in aVl and an important decrease in the height of the R wave in aVf. Thus nine of 16 cases showed a definite horizontal shift. The remaining seven showed no definite shift, and none showed a vertical shift.

A variety of electrocardiographic pictures were obtained, with the only consistent finding an inversion of QRS in aVr. One patient, however, presented an equiphasic QR complex in aVr. There was a marked tendency to inversion of the T waves in aVf with seven of these T waves inverted, and another four indistinguishable, out of the 19 total cases.

One patient showed abnormal T waves[20] in every limb lead, that in aVr being upright, while the other two were inverted. T in V_4 was upright, however. This is the same case whose standard leads showed a "left ventricular strain" pattern in the sitting position. The patient was a normal 20 year old male in apparent good health, with no signs or symptoms of either hypertension or myo-

cardial damage. Furthermore, his electrocardiogram in the recumbent position had been normal, except for a diphasic T in aVf.

No abnormalities of the P waves or RS-T segments were noticed in any of the tracings either standard or unipolar in any position. None of the inverted T waves suggested coronary T waves as they were all asymmetrical, and were not accompanied by bowing or displacement of the RS-T segments.

E. *The Effects of Deep Inspiration: (1) Recumbent Position.*

The effects of respiration were studied in both the recumbent and sitting positions with both types of electrocardiograms. The patients were asked to take a deep breath while both Leads III and aVf were being inscribed. In general, in the recumbent position, the results were not striking. Of the eight patients without a hemidiaphragmatic paralysis, five were thus tested. Not one showed any important change in the pattern of either Leads III or aVf according to the rigorous criteria of importance used throughout this study, except for the appearance of an inversion of P_3 in a single case.

Seven of the eight patients with a right phrenic crush were similarly tested. Three of these showed an important increase in the height of R_3 and a fourth showed an important decrease in the depth of S_3. With the unipolar leads, two of these same seven patients showed an important increase in the height of R in aVf.

Two of the three patients with paralysis of the left hemidiaphragm showed changes in the opposite direction with deep inspiration, namely an important decrease in the height of R_3 (Figure 3). One of this group also revealed a decrease in the height of R in aVf, and a disappearance of the T wave in this lead. These observations can only be explained on the assumption of paradoxical motion of the left side of the diaphragm in patients with interruption of the left phrenic nerve who are asked to take a deep breath.

F. *Effects of Deep Inspiration: (2) Sitting Position.*

In the sitting position respiration had more effect on the electrocardiogram. Five of seven patients without phrenic crush showed significant changes consisting of an increase in the height of R_3 in two cases, a diminution in the size of Q_3 in two, and a diminution in the size of S_3 in two cases. (One presented both R and S changes). In two cases a previously inverted T_3 became indistinguishable, and in a third an indistinguishable T_3 became upright. The unipolar leads revealed essentially similar results, with three of the seven presenting an increase in the height of R in

aVf. Curiously enough another case showed a paradoxical response, as there was an important decrease in the height of R in aVf.

Seven patients with right phrenic crush were tested in the sitting position. Four of these revealed respiratory variations consisting of an increase in the height of R_3 in one case, a decrease in the size of Q_3 in two, and a decrease in the size of S_3 in two,

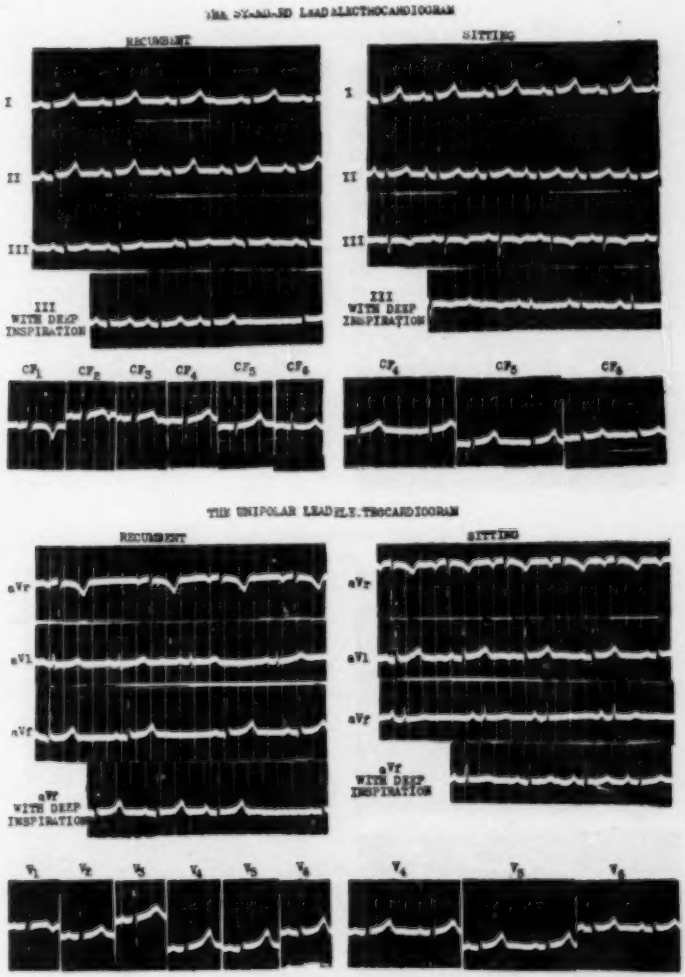

FIGURE 1: From a patient without a phrenic crush.

with both Q and R wave changes occurring simultaneously in one tracing. T_3 became upright in one case. Three out of these seven showed an increase in the R wave in aVf.

The three patients with left phrenic crush showed the expected changes in contrast to the paradoxical results observed when they were lying down. Thus one presented a decrease in the depth of S_3, and another showed a disappearance of the S wave in aVf.

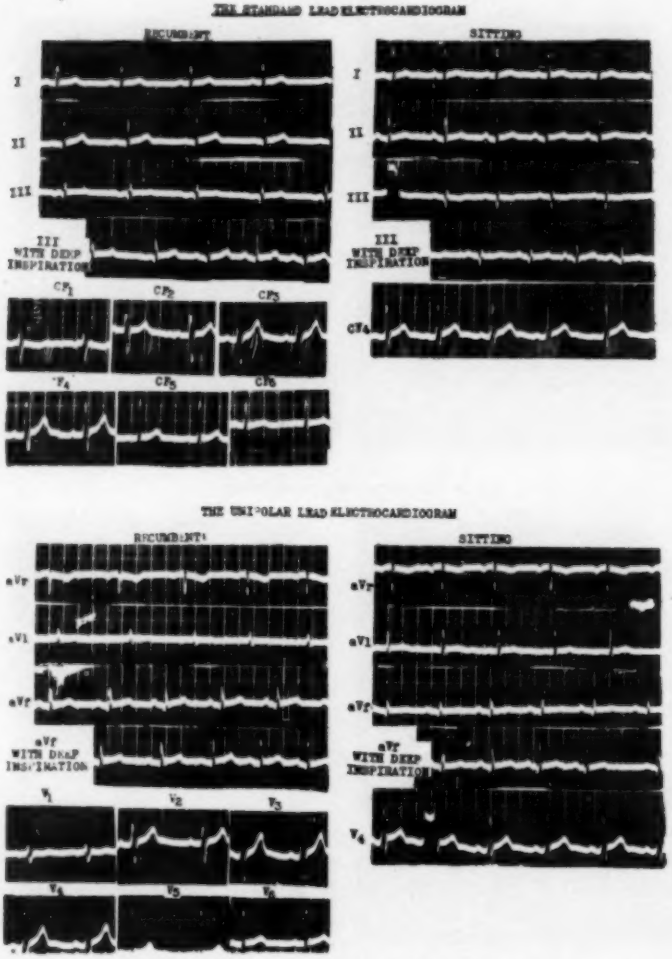

FIGURE 2: From a case with a right phrenic crush.

G. *Effects of Quiet Respiration.*

Changes were occasionally observed with quiet respiration during the course of taking the tracing. These consisted of variations in the height of the R and S waves in the CF and V leads, particularly those taken from the right side of the precordium. Both the R and S waves tended to decrease simultaneously when this occurred.

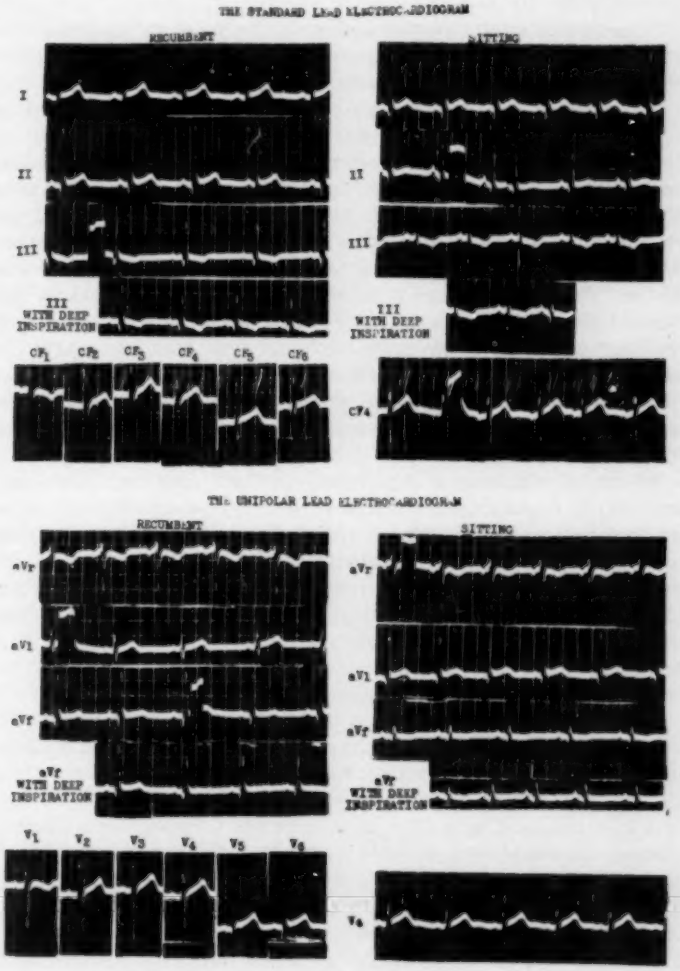

FIGURE 3: From a case with a left phrenic crush.

This was observed in four of the 19 patients in the recumbent position. In the sitting position leads from the right side of the precordium were not taken. Four of the patients showed similar changes in the standard extremity leads, however, and one showed such a change in aVl.

H. *Comparison of Standard and Unipolar Lead Electrocardiograms.*

In general the results obtained with the standard and unipolar lead electrocardiograms was essentially the same. This point is discussed in detail further on in the presentation.

V. *Discussion.*

The first conclusion that emerges clearly from the preceding observations is that nearly all the electrocardiograms taken by the standard method on patients with pneumoperitoneum in the recumbent position show normal tracings without axis deviation. These results are in entire agreement with those of Evans and Black,[6] and are in contrast to those of previous workers in the field.[1-3] We feel that one of the reasons for this discrepancy is that our criteria for axis shift might be more rigid than those of some other observers. Furthermore, the unipolar lead electrocardiograms present a variety of patterns nearly all of which are within normal limits. Evans and Black have previously observed the same results.

With the patients in the sitting position, however, the large majority of cases show a left axis shift by the standard lead method, and a deep Q_3 is not uncommon. In this position our results are in complete agreement with those previously reported by Elwood, Piltz and Potter.[2] Unfortunately, these writers do not state in what position their patients were placed when their tracings were taken. The same large majority of cases show a change to a more horizontal position of the heart by the unipolar lead electrocardiogram, in the sitting position.

The most important fact that becomes evident from this study, then, is that the change from the recumbent to the sitting position in patients with pneumoperitoneum is accompanied in most cases by a change in the standard lead electrocardiogram from a vertical axis to a left axis, and by a change in the unipolar lead electrocardiogram suggesting a more horizontal position of the heart. This is in contrast to the electrocardiographic changes in normal individuals upon rising from the recumbent to the sitting position observed by Sigler.[21] He noticed that axis changes were neither consistent nor striking, and observed occasional T wave alterations.

The question then becomes, what is the reason for this axis

shift? The first and most obvious possibility is that when patients with pneumoperitoneum rise from the recumbent to the sitting position the diaphragm must rise, in contrast to what is observed in normal individuals. This would elevate the apex and make the heart more horizontal. With this thought in mind, 12 of these patients were fluoroscoped by Dr. Roger Mitchell of the Trudeau Sanatorium both lying down and sitting, and the height of the diaphragm observed. The elevation of the diaphragm was recorded with reference to the posterior rib or posterior interspace reached. (Table V). It was found that contrary to expectations, in only one case did the left hemidiaphragm rise with this change in position. In seven cases the left hemidiaphragm descended one half to one posterior interspace, and in four it failed to move at all. Our first assumption, then, is obviously not borne out. The presence of left axis shift is not due to a rise in the diaphragm with resulting elevation of the apex of the heart, but occurs in spite of descent of the diaphragm and depression of the apex.

Several other possible explanations for the appearance of the left axis shift suggest themselves. The most likely hypothesis is that brought forward by Master[22] in his scholarly monograph on the effects of the heart's position on the electrocardiogram. After reviewing the literature on the subject, Master concludes that rotation is more important than simple dislocation in causing the electrocardiographic changes interpreted as left or right axis shift. Wilson[14] also agrees that the picture which he calls a change from a vertical to a horizontal heart may also be produced by counterclockwise rotation around the heart's long axis (as seen by a hypothetical observer placed at the apex). The writer suggests, then, that both classical and unipolar electrocardiograms were recording counterclockwise rotation of the heart rather than actual elevation

TABLE V

The Effect of Arising from the Recumbent to the Sitting Position on the Elevation of the Diaphragm (12 cases)

(The elevation of the diaphragm was determined fluoroscopically with reference to the appropriate posterior rib or posterior interspace)

			LT. LEAF DESCENDS		RT. LEAF DESCENDS	LT. LEAF ASCENDS
	No. of Cases	No Change	Rt. Leaf does not change	Both Leaves Descend	Lt. Leaf does not change	Right Leaf Descends
No Phrenic	5	2	0	2	1	0
Rt. Phrenic	5	1	2	1	0	1
Lt. Phrenic	2	0	0	2	0	0
TOTAL	12	3	2	5	1	1

of the apex. This is possible, because as Evans and Black[8] observed in all 10 of their cases, one of the effects of pneumoperitoneum is to displace the heart forward. With this thought in mind, the records were restudied. The fluoroscopic results were compared with the electrocardiographic ones with the following findings:

There were three cases where fluoroscopy failed to demonstrate any change in the height of either leaf of the diaphragm with assumption of the sitting position. Two of these showed no electrocardiographic changes with either type of electrocardiogram. The third (Figure 1) presented evidence of counterclockwise rotation by both methods. There were five cases where the left side of the diaphragm descended with changes in position, four of whom revealed evidence of rotation by the standard electrocardiogram, and three by the unipolar electrocardiogram. The fifth showed no change by either method. Two other cases were studied. In one patient the diaphragm descended on the right, but the left leaf remained immobile. This case presented evidence of counterclockwise rotation by both methods. One case actually did reveal elevation of the left hemidiaphragm by fluoroscopy. This patient presented no evidence of rotation by either method. The two remaining cases were not considered as the electrocardiograms were not complete in the sitting position.

In summary, then, descent of the left side of the diaphragm appeared to be associated with evidence of counterclockwise rotation, and immobility of the diaphragm appeared to be associated with no change in the electrocardiogram.

In general, throughout this study, no important difference was observed between the results obtained with the standard lead and the unipolar lead electrocardiogram. This statement is only to be interpreted, however, with the assumption that in this particular situation "left axis shift" in the standard leads and a "horizontal shift" in the unipolar leads are both evidence of counterclockwise rotation of the heart rather than actual elevation of the apex. With this interpretation, both methods seemed to be equally sensitive to the effects of rotation and produced parallel, if not identical, results.

The T wave abnormalities observed have already been mentioned. Rauchwerger and Erskine[18] have shown that T wave inversion may occur in any of the three standard leads, and in lead CF_4, in patients undergoing collapse therapy for pulmonary tuberculosis who show no sign of myocardial disease. Jaffe, Corday and Master[23] have recently pointed out that inversion of T_3 is not uncommon in normal obese individuals, and that inversion of T in CF_4 also may occur rarely in this group. These writers state, however, that they have never observed inversion of the T waves in any of the

V leads other than V_1 in their series of obese patients. This study agrees entirely with Rauchwerger and Erskine.[18] We observed frequent inversion of T_3 and occasional inversion of T in CF_4 and even in Lead I. In contrast to Jaffe, Corday and Master's observation, however, we observed twice an inverted or diphasic T wave in V_3 and V_4. Analysis of the T waves in the unipolar limb leads was somewhat more difficult owing to the fact that there is no general agreement as to what constitutes normal findings. Jouve and Senez[20] feel that inversion of T in aVl or aVf is abnormal when the QRS in those leads is directed upward. Both of these did occur repeatedly in our series, however. We agree with Goldberger,[15] therefore, that such changes are not evidence of myocardial damage.

The effects produced by respiration on the heart rate are also of more than passing interest. This part of the study was done in order to test the hypothesis that the deep Q_3 due to displacement of the heart could be made to disappear by asking the patient to take a deep breath. Our results show, however, that in the recumbent position, deep inspiration had no effect on the electrocardiogram in patients who had not received phrenic crush. It usually, but not always, did have such an effect in patients who had had phrenic nerve interruption, but in patients with left phrenic crush the effects were sometimes paradoxical. It would appear, then, that this test has to be interpreted with caution in patients with pneumoperitoneum.

SUMMARY

1) Standard and unipolar lead electrocardiograms were taken in both the recumbent and sitting positions in 19 patients receiving pneumoperitoneum as treatment for pulmonary tuberculosis.

2) In the recumbent position, the majority of the patients presented a normal electrocardiogram with a vertical axis.

3) In the sitting position, however, a majority of the patients showed changes consistent with the development of a left axis shift in the standard electrocardiogram, or of a horizontal shift in the unipolar lead electrocardiogram.

4) Numerous abnormal T waves were observed in these tracings, especially in the sitting position.

5) There was no important difference throughout this study between the results obtained with the standard lead and the unipolar lead electrocardiograms.

6) Possible explanations for the above findings are discussed.

Acknowledgements: The writer is indebted to Dr. Edward N. Packard and Dr. Roger S. Mitchell of the Trudeau Sanatorium for help and encouragement during the course of this study; and to Dr. Alfred Angrist,

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RESUMEN

1) Se obtuvieron electrocardiogramas corrientes y unipolares, en la posición acostada y en la sentada, en 19 tuberculosos pulmonares que recibían el neumoperitoneo terapéutico.

2) Acostados, la mayoría de los pacientes presentaron un electrocardiograma normal con el eje vertical.

3) Sin embargo, sentados, la mayoría de los pacientes revelaron alteraciones compatibles con el desarrollo de un desplazamiento del eje hacia la izquierda en el electrocardiograma regular, o de un desplazamiento horizontal en el electrocardiograma unipolar.

4) Se observaron en estos trazados numerosas ondas T anormales, especialmente en la posición sentada.

5) Durante esta investigación no se halló diferencia importante alguna entre los resultados obtenidos en los electrocardiogramas corrientes y en los unipolares.

6) Se discuten las posibles explicaciones de los hallazgos obtenidos.

RESUME

1) Des électrocardiogrammes en dérivations standard et unipolaires ont été faits dans les deux positions, couchée, et assise chez 19 malades traités par pneumopéritoine pour tuberculose pulmonaire.

2) Dans la position couchée, la majorité des malades présente un électrocardiogramme normal, avec un axe vertical.

3) En position assise cependant, la majorité des malades montre des modifications, consistant dans le développement du dessin de l'axe gauche sur l'électrocardiogramme standard, ou du dessin horizontal dans les dérivations unipolaires.

4) On observe de nombreuses ondes T anormales dans ces tracés, surtout dans la position assise.

5) Il n'y a pas de différence importante d'apres cette étude entre les résultats obtenus entre les électrocardiogrammes à dérivations standard et à dérivations unipolaires.

6) L'auteur discute les différentes hypothèses que suggèrent les constatations ci-dessus.

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The Roll of Bronchoscopy in Artificial Pneumothorax*

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The development of artificial pneumothorax in the management of pulmonary tuberculosis during the past forty years has given an entirely new and more hopeful outlook to the patient. As the technique of closed pneumonolysis was developed and perfected this outlook further greatly improved. However, there nevertheless remained a sizable group of patients with tuberculosis apparently treatable by pneumothorax, that did not properly respond unless other means of care could be provided. These situations or cases inevitably developed into one or more of the major complications resulting in either chronic invalidism or fatal termination.

Everyone active in pneumothorax care has been frequently confronted with the problems of unclosed cavities without apparent cause. Atelectatic pulmonary segments, or even atelectasis of an entire lung are commonly encountered. The distressing problem of sputum positive for tubercle bacilli in the presence of what appears to be an entirely satisfactory pneumothorax is known to all.

During the past 18 years much has been learned of endobronchial tuberculosis, its diagnosis, its management and the management of the associated parenchymal disease. However, in this discussion endobronchial disease is dealt with only as associated with artificial pneumothorax therapy.

The place of the bronchoscope in artificial pneumothorax therapy is one of diagnosis, and one of therapy as well. It is assumed that in the management of these patients, the best results are obtained when the bronchial segments draining pulmonary disease drain freely and function as normally as possible. The interest of the writer was stimulated by concern over those patients in whom inadequate drainage of diseased areas so frequently resulted in a decline of the clinical and pathologic status.

It is not infrequent to find that an apparently satisfactory pneumothorax has been established, and that any or all adhesions have been severed, and yet find that a wide open cavitation remains. It is well known that unless closure is obtained, a high incidence of empyema follows and, without further interference,

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in a maximum of three years practically all of these patients are dead. In dealing with this aspect it must here be stated that for one of several reasons surgical resection is wholly impossible—impossible because of serious disease in the contralateral lung or, as is occasionally the case, impossible because of its unavailability. As an illustration of this situation I would like to offer three cases in which there were large unclosed cavities in what were otherwise satisfactory pneumothoraces. Surgical resection was wholly impossible because of severe contralateral disease, and by bronchoscopic management of coexisting endobronchial disease, uneventful recovery was effected.

Case 1: Mrs. S. J. was a 30 year old white housewife in whom a diagnosis of far advanced pulmonary tuberculosis with bilateral cavitation was made in January, 1944. Right artificial pneumothorax was begun, and several adhesions were severed by closed pneumonolysis. Figure 1 shows a large unclosed cavity in the right upper lobe after the pneumothorax had been established. As well, on the left side far advanced disease was present with multiple cavities. Because of the apparent virulence of the disease left pneumothorax was established before attempting closure of the large cavity in the right upper lobe (Figure 2). In April bronchoscopy revealed a large amount of tuberculous granulation in and about the orifice of the right upper lobe bronchus. No evidence of endobronchial disease was seen elsewhere in the tracheobronchial tree. Accordingly, the granulations were rubbed off with a dry sponge and the underlying area cauterized with 30 per cent silver nitrate for ten seconds and then neutralized with 70 per cent alcohol. Before removing the bronchoscope a curved aspirater was introduced as far as possible into the right upper lobe bronchus, and a large amount of thick tenacious secretion was aspirated. Within a matter of hours there was a marked drop in temperature; and sputum, which had been meager, became near copious in volume. This procedure was repeated at weekly intervals for three treatments, at the end of which time the large cavity in the right upper lobe was completely closed (Figure 3) and her sputum was scant. She became negative for tuberculous bacilli on gastric culture within eight weeks. This patient is living and well, without any recurrence five and one-half years later.

Case 2: M. S. was a 13 year old Latin American girl in whom a diagnosis of far advanced pulmonary tuberculous with bilateral cavitation was made in the spring of 1944. Figure 4 shows right artificial pneumothorax with a huge tention cavity occupying practically all of the right lobe (note lateral too—Figure 5). In the left uncollapsed lung is seen a moderate amount of exudative disease with a sizable cavity. This child was promptly bronchoscoped, and the entire major bronchus to the right lower lobe was found choked with tuberculous granulations that bled with the gentlest touch. The remainder of the tracheobronchial tree appeared normal. By a similar procedure as described above these granulations were removed, and the underlying surface cauterized. During the 24 hours following the first bronchoscopy, the sputum was as copious as if the diagnosis were acute putrid abscess. Within another 24 hours this patient was afebrile. The procedure was repeated at weekly intervals

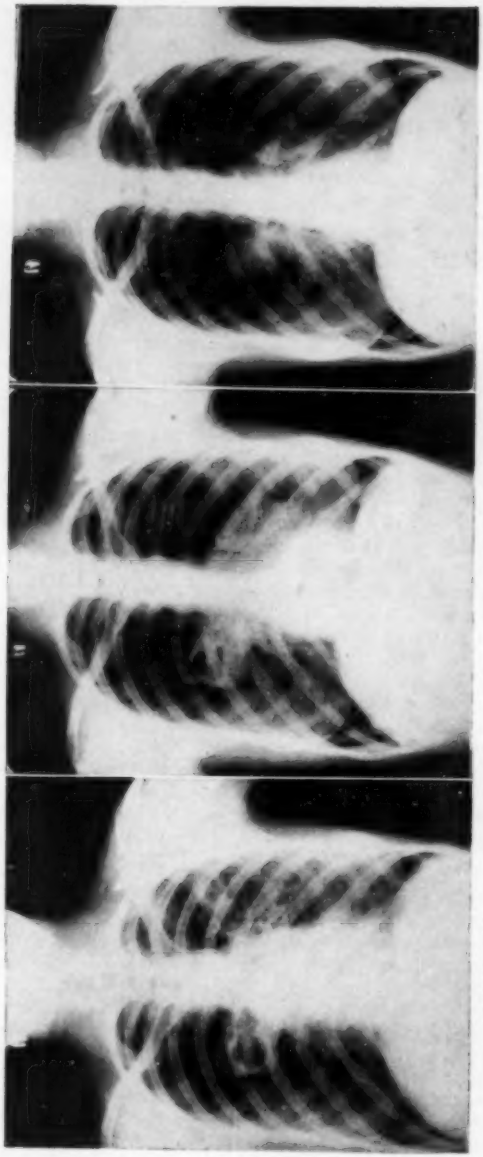

FIGURE 3

FIGURE 2

FIGURE 1

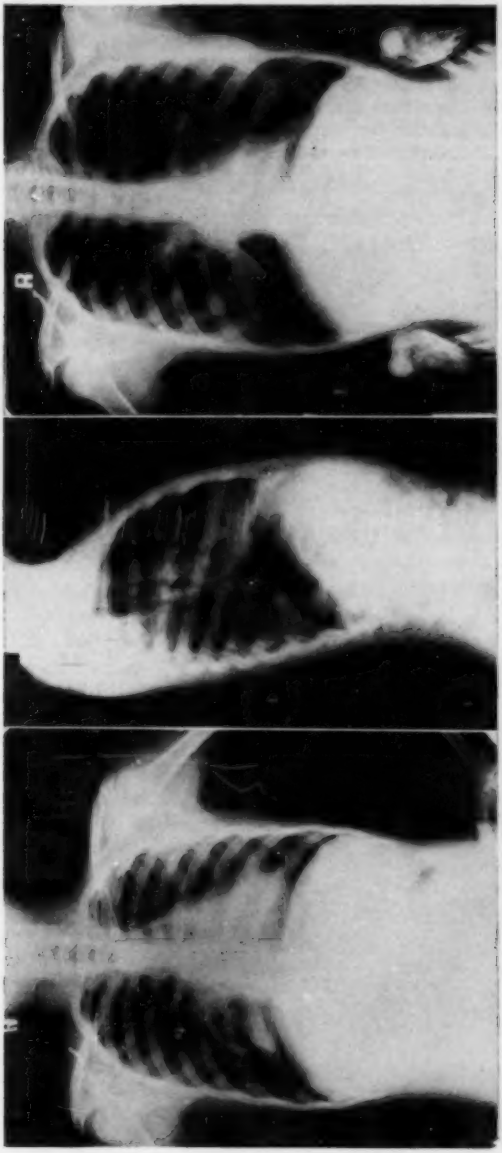

FIGURE 6

FIGURE 5

FIGURE 4

for a total of four treatments, at the end of which time the cavity had closed, and a left artificial pneumothorax was then begun. Because of the age, the race, and the location of this large cavity, she was watched with extreme care in hopeful anticipation of recovery. This was clinically without event, save for the curious shrinking of the remnants of the right lower lobe to a thin fibrous tongue as seen in Figure 6. Two years after this child's clinical recovery, a plastic pleuritis forced re-expansion of the right lung, and it has since remained well.

Case 3: Mrs. L. M. was a 28 year old housewife in whom a diagnosis of moderately advanced unilateral pulmonary tuberculosis was made in

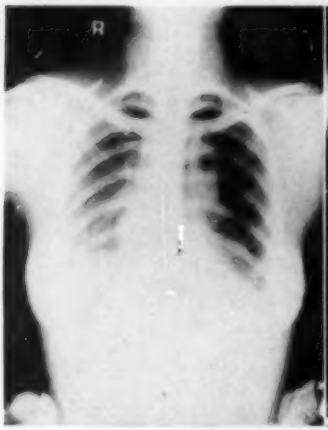

FIGURE 7

FIGURE 8

FIGURE 9

FIGURE 10

July, 1945. Left artificial pneumothorax was established in August, and followed by a simple closed pneumonolysis in September, 1945. Save for a large unclosed cavity in the left upper lobe, the pneumothorax appeared satisfactory (Figure 7). Clinically, however, she was toxic and febrile. In this instance, the recent war had just closed, and resection could not be seriously considered because of its unavailability at the time in the patients immediate area of residence. After two months this patient, showing no change in her disease status, was bronchoscoped, and in and about the orifice of the left upper lobe bronchus was found sufficient tuberculous granulation to almost completely obliterate the opening. As previously described the granulations were removed and the underlying base cauterized. In one week the procedure was repeated, and there was prompt closure of the cavity, followed in short order by sputum negative for tubercle bacilli (Figure 8). This patient now, after four years, is entirely well and is undergoing re-expansion of the left lung (Figures 9 and 10).

During the year of 1944 in a group of 98 pneumothorax patients, the above described condition occurred nine times. Although there are no statistics available, it seems that this relatively high incidence must have been purely coincidental. Subsequent observation has revealed a fairly stable incidence of about 5 per cent. During the year of 1945, in 119 pneumothorax patients, this situation arose in only six patients. Because of the importance of a long follow-up to ascertain whether or not the cavities treated in this manner closed only temporarily or permanently, no cases are included after January 1, 1946.

The 15 cases, referred to above, all closed their cavities promptly under the management described, and have remained well. How-

FIGURE 11

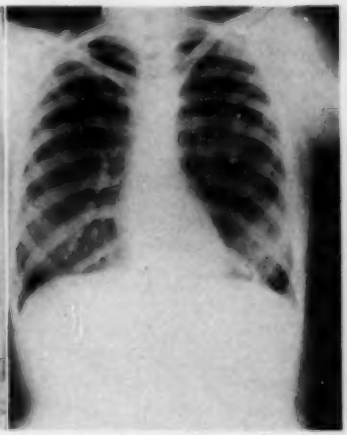

FIGURE 12

ever, it is pertinent to call attention to one of three, that occurred during 1946, 1947 and 1948 in which recovery was only apparent, and reopening of the cavity occurred after six, 10 and 12 months respectively.

Mrs. L. V., a 20 year old Latin American housewife, was diagnosed as having moderately advanced pulmonary tuberculosis in May, 1948. Left artificial pneumothorax was established. After pneumonolysis a large cavity remained, and bronchoscopy revealed obstructing endobronchial disease in the left upper lobe bronchus. This was treated in the previously described manner, and followed by prompt closure of the cavity (Figure 11). She remained well and became ambulatory only to have this cavity reopen in 10 months (Figure 12).

It is impossible to say at this time, but it is believed that when such a reopening is encountered that the bronchial disease, with its attendant obstruction to adequate drainage, has extended beyond reach of ordinary bronchoscopic technique. It must be added further, that since the beginning of this work, the addition of streptomycin is certainly materially brightening the patient's outlook.

Bronchoscopy as a means of identifying and removing obstructive exudative bronchial plugs has long been in use. However, it must be added that these plugs do occasionally occur, and their aspiration is doubly important in the pneumothorax patient, because, there is not only the hazard of acute purulent infections and bronchiectasis, but the addition of the tubercle bacillus to vastly complicate the picture (Figs. 13 and 14).

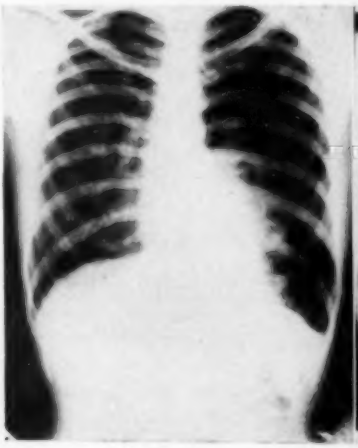

FIGURE 13

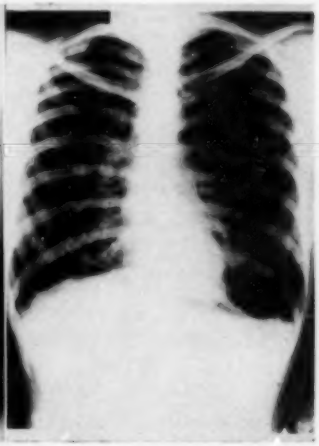

FIGURE 14

Bronchoscopy is frequently a necessary aid in identifying the source of a positive sputum. It is not uncommon for the patient to have progressed entirely satisfactorily by clinical and x-ray examination, and yet have sputum still occasionally positive for tubercle bacilli. Bronchoscopy frequently is the means of identifying and treating an active endobronchial lesion. This, of course, occurs frequently in all patients with pulmonary tuberculosis with or without pneumothorax care.

SUMMARY

The role of bronchoscopy in artificial pneumothorax care has been identified as one of diagnosis and treatment as well. Fifteen cases of unclosed cavities in what were otherwise satisfactory pneumothoraces are reported. They had obstructing endobronchial disease that was treated bronchoscopically with complete recovery in each instance—recovery that was substantiated by a four year follow-up.

RESUMEN

En la terapia con el neumotórax artificial la broncoscopia desempeña un papel importante tanto en el diagnóstico como en el tratamiento. Se comunican quince casos de cavernas que no se cerraron en neumotóraces que por lo demás eran satisfactorios. Todos estos casos presentaban enfermedad endobronquial obstructiva, que fue tratada por medio del broncoscopio, con recuperación completa en cada caso—una recuperación que fue comprobada por una observación subsecuente de cuatro años.

RESUME

Dans le pneumothorax artificiel, la bronchoscopie joue un rôle important, soit comme moyen diagnostique, soit comme traitement. L'auteur rapporte 15 cas de cavités non fermées pour lesquelles les pneumothorax semblaient par ailleurs satisfaisants. Tous ces cas présentaient une atteinte bronchique ayant déterminé une obstruction, qui fut traitée bronchoscopiquement avec guérison complète dans chaque cas, guérison contrôlée par quatre années d'observation.

Bronchography in Pulmonary Tuberculosis

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The recognition of tuberculous bronchitis as a clinical entity has been of practical importance to the chest man. The presence of this complication in the main or lobar bronchi is known to be associated with interference with the normal physiological function and may be aggravated by any form of collapse therapy. Thus bronchoscopy is being extensively used in sanatoria. One of the most important lessons learned from this complication is that once tuberculous bronchitis has been established, particularly as an extensive lesion, it may be a source of positive sputum. This is of particular significance in cases where there are no demonstrable lesions in the pulmonary parenchyma and also in cases where the lesions appear controlled but sputum remains positive. The following case illustrates this point:

H.E., male, aged 31 years, was admitted to Mountain Sanatorium in August, 1936 because of positive sputum. His history of illness dated back to 1920 when he was a patient in a California Sanatorium for 10 months for an upper lobe lesion. He was treated by bed rest only. In 1934 a specimen of sputum was found positive but because of doubtful activity in the right upper lobe, he was discharged after five months, with a negative sputum. On his admission to the Mountain Sanatorium in 1936 the lesion in the upper lobe remained unchanged and was considered inactive, but because of persistently positive sputum, right pneumothorax was started soon after admission and right pneumolysis carried out in February, 1937. Shortly after the latter procedure he developed a persistent wheeze. During the night of March 8, 1937 he had a fatal hemorrhage. Postmortem examination showed tuberculous ulceration of the lower part of the trachea, of the right main and right upper lobe bronchi. The ulceration in the upper bronchus led to perforation of the right pulmonary artery. Sections of the upper lobe showed partially calcified nodules but no active disease.

In the past we have concerned ourselves chiefly with the findings in the bronchi as seen through the bronchoscope, but in some of the cases with negative findings in the major bronchi we felt the need of studying the segmental branches. We have, therefore, added bronchography to our investigations. The cases studied were those who have had medical or surgical treatment and in whom usually a positive sputum persisted. Of particular interest to us were the

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post thoracoplasty cases who obviously had a satisfactory collapse, negative bronchoscopic findings and positive sputa. Also, in view of the increasing number of resections done in our institution, the opportunity presented itself to study the whole bronchial tree clinically and pathologically. In addition to post thoracoplasty cases with positive sputum, we made bronchograms on the cases who had to have some major surgical procedure.

Bronchography in tuberculosis has not been used extensively (1) because of the fear of spread of disease in the process of coughing up of lipiodol, (2) because of the presence of residual lipiodol in the lung which may interfere with the interpretation of the x-ray films for months, and (3) because of the fear of the effect of Iodine on the patient. As will be mentioned later these reasons were found to be of no importance in our experience.

This group of 100 patients studied by bronchography consisted of 53 females and 47 males. The majority (88 per cent) were between 20 and 50 years of age. The youngest was a girl of 17 and the oldest a man of 65. In this group 11 per cent were of minimal extent, 58 per cent moderately advanced, and 31 per cent far advanced. The majority as seen were in the moderately advanced group probably because this is a group more likely to require surgery than the minimal group and better able to tolerate surgery than the far advanced group. The method of bronchography used is the one practiced in Groningen University Hospital and shown to us by Dr. G. Smelt. It chiefly consists in posturing the patient according to position of the ostium to each lobar bronchus, filling it with an assigned quantity of lipiodol and then posturing the patient again according to the course of the segmental branches of the lobar bronchus. No fluoroscope and no tracheal catheter is used for this method. The procedure of filling one lung at a time should take a little over one minute and the x-ray films are taken immediately afterwards. Ten to 12 cc. of lipiodol at room temperature are used for one side. After the posterior-anterior, lateral and oblique films are taken, the patient is again placed in a position corresponding to the disease area studied. He remains in this position until the films are developed and studied. If the films are satisfactory he is immediately put in a position to drain the lipiodol. Should more information be required, more films are taken.

Bronchoscopic Examination

All patients with the exception of two were bronchoscoped before the bronchograms were done. The interval of time between bronchoscopy and bronchography varies considerably as bronchography was not necessarily a planned procedure at the time of

bronchoscopy. A few patients had lipiodol introduced at the time of bronchoscopy, but on the whole, this method was found less satisfactory than the one used on the rest of the patients and described above. Of the 98 patients bronchoscoped, 54 cases were found to have no pathology. The rest showed such pathology as stenosis of a lobar bronchus (16), some localized infiltration (21), some tuberculous infiltration with stenosis (6), and one case showed extra bronchial pressure stenosis. No cases of extensive ulceration was found in this group. The presence of a red and generally thickened mucosa was not considered pathognomonic of tuberculosis. From these figures it is apparent that a small majority of the patients under investigation had no pathology of the bronchial tree as diagnosable by the bronchoscope.

Diagnosis of stenosis of a main or lobar bronchus is much more accurate by bronchoscopic examination than bronchography as in only three bronchograms was this noted. It is of note that of the 54 cases with negative bronchoscopic findings there were 51 who had satisfactory bronchograms and of these, 41 or 80 per cent, were abnormal. It is obvious, therefore, that a negative bronchoscopic finding does not rule out the possibility of disease in the segmental bronchi. The remaining 10 cases (20 per cent) with negative bronchoscopic findings and satisfactory bronchograms had normal bronchial trees.

It might also be pointed out here that of the 51 cases with negative bronchoscopic examination, 25 (50 per cent) showed beading on the bronchograms. As this beading (a form of bronchiectasis) is most likely due to present or past tuberculous bronchitis, it is apparent that many cases of tuberculous bronchitis are not being diagnosed by the bronchoscope. This would appear to be a most important observation in view of the beneficial effect streptomycin has on most cases of tuberculous bronchitis.

Conversely, one may now consider those cases with normal bronchograms to see what the bronchoscopic examination showed. Of the 12 normal bronchograms, one showed tuberculous bronchitis six months prior to bronchography which had improved on later bronchoscopy and might have been healed by the time bronchography was done. One case was not bronchoscoped and the other 10 showed no abnormality on bronchoscopic examination.

There are various terminologies available for the naming of the segmental bronchi, and the nomenclature we have adopted is that proposed by the International Congress of Otolaryngology, July 1949.

Of the 100 bronchograms done (Table I), there were 12 normal, 83 abnormal and five unsatisfactory. The small number of normal and the large number of abnormal bronchograms indicates how

much more frequently the bronchial tree is involved in pulmonary tuberculosis than might be suspected, and this difference may also be indicative of the usefulness of bronchography in the study of particular cases of pulmonary tuberculosis. The unsatisfactory bronchograms included those where there was poor filling of the bronchial tree as a whole, or where there was some other complicating factor that made the interpretation of the x-ray films too difficult to be sufficiently reliable to be of use. Those bronchograms done through the bronchoscope were the least reliable and as there are many factors intrinsic and extrinsic contributing to good bronchograms, a rate of 5 per cent unsatisfactory films is not considered high.

Table II lists the various abnormal findings on bronchography and the number of cases in which each appeared. In some cases there was obviously more than one type of abnormality present, for instance, stenosis and beading of two different bronchi might be present in the same patient.

TABLE I

BRONCHOGRAMS

RIGHT	64	LEFT	36
Normal	5	Normal	7
Abnormal	55	Abnormal	28
Unsatisfactory	4	Unsatisfactory	1

Total	100
Normal	12
Abnormal	83
Unsatisfactory	4

TABLE II

ABNORMALITIES IN THE BRONCHOGRAMS

Bronchiectasis:	
Beading	48
Saccular	3
Fusiform	12
Cylindrical	6
Other Findings:	
Cavity	4
Broncho-pleural fistula	2
Stenosis	3
Contraction of Lobe or Segment (bunching of the bronchi)	16
Poor filling of one or more bronchi	22
Stump of a bronchus	1

In four cases lipiodol was demonstrated in cavities but bronchography is not recommended as a means of diagnosing the presence of cavities. However, in rare instances it may be useful in segmental localization of a cavity. Neuhof[7] found bronchography useful in diagnosis of obscure cavities by indirect evidence, i.e., in the disposition of the bronchi around the site of a cavity.

The diagnosis of broncho-pleural fistula by bronchography may be a most important procedure, particularly if the fistula follows lobectomy or segmental resection and the fistula leads into a small empyema pocket.

Contraction of a lobe, often the right upper, was easily demonstrated by the bunching together of the bronchi of a lobe and poor filling of the small branches. Although collapse of a lobe is often evident by other more frequently used procedures, in some cases bronchography demonstrated whether the collapse involved one or more than one lobe or segment. In 22 cases there was poor filling of one or more of the bronchi. There were various reasons for this, some pathological such as stenosis, or the presence of secretions, and some mechanical causes such as improper positioning of the patient and insufficient lipiodol. Taking into account the bronchoscopic findings and other investigations, it was usually possible, in these cases of poor filling of a bronchus, to decide if it was due to a local pathological process.

Lobar and Segmental Distribution of Bronchographic Abnormalities

Tabulation of the various lobes affected shows that it is the upper lobes where bronchographic abnormalities were more frequently found. Forty-three of the 55 abnormal right bronchograms showed involvement of the upper lobe and in the left lung 26 of the 28 abnormal left bronchograms showed involvement of the upper lobe.

By a slight majority only one lobe of either lung was involved and in only nine cases was the right middle lobe bronchi abnormal either alone or in combination with the remainder of the right lung.

The segmental branches of the upper lobe bronchi most frequently involved were the posterior and the apical in that order, and the anterior branch of the upper lobe bronchus was seldom involved. In the lower lobe, in either lung, it is the apical segmental bronchus tha tis involved in the majority of cases. In 45 cases where the lower lobe bronchi were abnormal the apical segmental branch was abnormal in 30 alone, and in association with the basal branches in seven cases. In only eight cases were there abnormalities of the basal branch bronchi alone.

Residual Lipiodol

The presence of residual lipiodol in the lungs is often given as a contra-indication to bronchography in the presence of pulmonary tuberculosis, as the lipiodol may remain for months or years and causes mottled shadows on the x-ray film. Admittedly this does happen in a small percentage of cases as shall be shown by our figures but it happened so seldom, and since the shadow of lipiodol is quite characteristic on the x-ray film, we do not consider it a contra-indication if bronchography will help in the investigation of a case. It should be mentioned that those patients showing the slowest clearing of lipiodol were those who had had pleurisy in the past.

In no case has there been any harmful effect on the patient and no spread of disease was noticed. In one patient only, early in this series, was some lipiodol found in the opposite lung. This is explained by the fact that he drained the lipiodol by lying on the opposite side.

In 50 cases there was good follow-up with x-ray films to determine the time required to eliminate the lipiodol. The following figures are of interest.

Clearing of Lipiodol in less than	1 week	13 cases		
Clearing of Lipiodol in less than	2 weeks	2 cases	31	43
Clearing of Lipiodol in less than	3 weeks	3 cases	62%	86%
Clearing of Lipiodol in less than	4 weeks	13 cases		
Clearing of Lipiodol in less than	8 weeks	12 cases		
Clearing of Lipiodol in less than	12 weeks	3 cases		
Clearing of Lipiodol in less than	16 weeks	3 cases		
Clearing of Lipiodol in less than	20 weeks	1 cases		

Reactions to Lipiodol

Iodism was no tencountered in any case in this series.

Relationship of Bronchography to Surgery

Bronchography was carried out on 10 post thoracoplasty cases and four post lobectomy cases. This was done because of persistent positive sputum. As further surgical procedures were conducted on some of them only recently, the follow-up of these cases will be of interest. Altogether during this study, 23 cases of thoracoplasty, six pneumonectomies and 16 lobectomies were done. Although the usual indications for thoracoplasty or resection were applied, the presence of gross bronchiectatic dilations or occlusion of a segmenal branch helped to tip the scales in favor of resection. Fine beading of one or several branches were not considered a contra-indication to thoracoplasty. These cases of thoracoplasty will be followed up and will constitute the subject for another study. Of particular interest to us was a case of a broncho-pleural

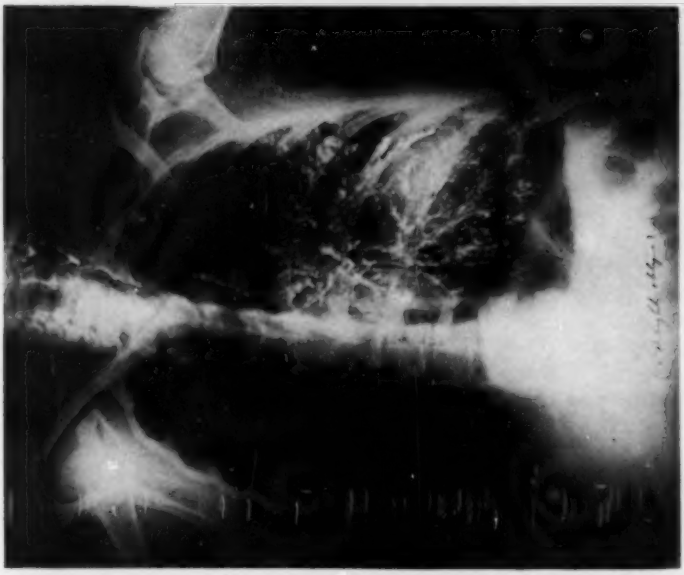

FIGURE 2

FIGURE 1

fistula that developed following a right lower lobectomy and led to formation of an encapsulated empyema. The usual signs of a broncho-pleural fistula were absent and the diagnosis was made only when a bronchogram was done. Thoracotomy confirmed the diagnosis and further resection was necessary.

We have had little luck in demonstration of tuberculomas. This is probably because these lesions are located between the bronchi and interfere little with the lumen of them. In some of them fine beading was present and in some a small branch was obstructed. In general, bronchography was of help only in the exact localization of the lesion.

Correlation of Bronchographic to Pathological Findings

In all cases of resection the pathologist found gross lesions in the form of small or large cavities, small or large areas of caseation and in some tuberculomas. In no case was the lesion entirely limited to disease in the bronchi but was always associated with some findings in the parenchyma. Fibrosis was not an outstanding feature in most of the cases. In 14 out of the 22 cases of resection the bronchographic findings were shown to exist on biopsy. In some of the cases examination of the affected bronchi was not carried out so that there is no correlation between the bronchographic and pathological report. Another factor which may influence the rate of accuracy in reading bronchograms is the experience of the interpreter, as the largest number of cases where there was a discrepancy occurred early in the series and later on, with more experience, the reading became more accurate.

The following cases are presented as examples of the usefulness of bronchography in pre-surgical investigation:

Case 1: Mr. W.M., aged 35, was admitted to the Mountain Sanatorium in January 1947, with a diagnosis of pulmonary tuberculosis, far advanced, bacillary, and diabetes mellitus. The pulmonary disease was confined to the right lung and there was cavitation in the apex. During the next 22 months he was treated with bed rest and two courses of streptomycin totalling 107 grams. As his diabetes was difficult to control he was never considered suitable for surgery until October 1948, when preoperative bronchogram showed bronchiectasis of all segmental bronchi of the right lung. Because of this a right pneumonectomy was done on November 3, 1948. Pathological examination of the removed lung showed (1) pulmonary tuberculosis with cavitation, (2) fibrosis, (3) bronchiectasis. Before operation his sputum had been persistently positive for tubercle bacilli by culture, and since operation there have been four negative cultures to date, and no positives. Without the bronchographic evidence of widespread bronchiectasis a right thoracoplasty would probably have been the treatment prescribed. Figure 1 is a reproduction of the bronchogram in this case.

Case 2: Mrs. G.G., aged 28, was first admitted to a sanatorium in May 1941, following severe hemoptysis. Left pneumothorax was unsuccessfully attempted in May 1941, and left phrenic crush was done in December 1941, and repeated in November 1943. She was discharged in December 1943, and had regular check-ups until November 1945, when she had another severe hemoptysis and was re-admitted in December 1945. In June 1946, she had a repeat phrenic crush and in March 1947 pneumoperitoneum was initiated. In August 1948, a positive sputum was obtained for the first time in eight months. In November 1948, she was transferred to the Mountain Sanatorium for consideration of surgery. A left bronchogram revealed beading of the apico-posterior segmental branch and cylindrical dilatation of the peripheral portions of the lingula bronchus. Left upper lobectomy was done in February 1949, and the pathological examination of the lobe showed a small (1 cm.) tuberculoma, well walled off with a fibrous capsule, at the apex, and bronchiectatic dilatation of the apico-posterior and lingula segmental branch bronchi. One positive sputum was obtained the month previous to operation, and two negative since. As the patient was transferred back to her home sanatorium two months after operation a longer follow-up has not been done. Figure 2 shows a right oblique view of the left bronchogram.

Discussion

The incidence of tuberculous bronchitis in the major bronchi as seen in postmortem has been reported by different writers. Salkin, Cadden and Edson[9] found an incidence of 40 per cent; Bugher, Littig and Culp[2] in 41 per cent and Silverman[10] saw it in 60 per cent and where large cavities were present an incidence of 70 per cent. The most frequent lesions found were tubercles beneath the epithelium and in the submucosa. Gross ulcerations were infrequent. In view of these findings it is easy to understand why these lesions are frequently missed on bronchoscopic examination. The segmental branches which cannot be outlined and observed through the bronchoscope have been studied by bronchography. In our series of 100 cases we found 83 abnormal bronchograms. Dormer, Friedlander and Wiles[3] in their extensive study of bronchography in pulmonary tuberculosis feel that in the majority of cases the basic disease is bronchial block. Murphy[6] found bronchial dilatation in 60 per cent of his cases. Mitchel and Thornton[5] state that in a recent review of 52 lobectomies for pulmonary tuberculosis, 12 patients had bronchiectasis.

Meissner[4] in his study of 60 resection cases found that 31 had tuberculosis of the major bronchi and in this latter group all the segmental bronchi were involved. These latter findings prompted Overholt[8] to make the statement that tuberculous involvement of the segmental bronchi is almost universally associated with parenchymal tuberculosis.

Of interest is the fact that most of the lesions found in our study were in the dorsal branches of the upper and lower lobes, a fact

which corroborates R. C. Brock's[1] hypothesis of bronchial embolism and posture which he so convincingly defends in his excellent book.

We, however, have not found in our series a single case where the subapical branch of the lower lobe was involved, while Brock found that "abscesses of the apical and subapical segments often co-exist."

That tuberculous bronchitis may heal spontaneously without leaving permanent changes in the bronchus is a well known fact, particularly this is the case where the submucosa is not destroyed. In cases where there is extensive ulceration with blocking of the bronchus conditions are created for permanent changes with formation of bronchiectasis which may act as a source of positive sputum. In other words, in most of the cases, even in the presence of bronchial disease, good drainage of the bronchus and resistance of the patient will facilitate healing, while in some the extensive destruction of the bronchus will result in creation of a source of positive sputum. As 50 per cent of our cases showed beading, a type of not too extensive bronchiectasis, and as thoracoplasty was carried out on most of them, it will be of interest to follow them with reference to sputum conversion.

Further bronchographic investigations with more detailed pathological studies of the resection cases may in time add considerably to our present indications for major thoracic surgery. Tuberculosis, as Murphy[6] stated, is a broncho-pulmonary disease and should be treated as such.

SUMMARY

1) One hundred cases of pulmonary tuberculosis studied by bronchography are reviewed.

2) Bronchography supplements bronchoscopy and is a practical procedure in pulmonary tuberculosis.

3) The usual contraindications to bronchography in pulmonary tuberculosis, (1) spread of disease, (2) residual lipiodol, (3) iodism, are not important.

4) As a pre-operative procedure bronchography may be as important as bronchoscopy.

5) Bronchography is particularly useful in localization of lesions; demonstration of tuberculous bronchiectasis of segmental bronchi; demonstration of some broncho-pleural fistulae; and in differential diagnosis between a contracted and atelectatic lobe.

6) Negative bronchoscopic examination does not rule out segmental bronchial disease.

7) The majority of lesions occur in the posterior segment of the upper lobe and the apical segment of the lower lobe.

RESUMEN

1) Se revisan cien casos de tuberculosis pulmonar estudiados por broncografía.

2) La broncografía auxilia a la broncoscopía y es un procedimiento práctico en tuberculosis pulmonar.

3) Las contraindicaciones habituales para la broncografía en tuberculosis: (1) diseminación de la enfermedad, (2) lipiodol residual y (3) yodismo, no son importantes.

4) Como medida preoperatoria la broncografía puede ser tan importante como la broncoscopía.

5) La broncografía es particularmente útil para localizar las lesions, la demostración de bronquiectasia tuberculosa de los bronquios segmentarios; demostración de algunas fístulas broncopleurales y en la diferenciación entre lóbulo retraído y lóbulo atelectático.

6) La mayoría de las lesiones ocurren en el segmento posterior del lóbulo superior y en el segmento apical del lóbulo inferior.

RESUME

1) L'auteur étudie une centaine de cas de tuberculose pulmonaire examinés par bronchographie.

2) La bronchographie complete la bronchoscopie et constitue un procédé pratique en tuberculose pulmonaire.

3) Les contrindications habituelles a la bronchographie dans la tuberculose pulmonaire ne sont pas importantes: diffusion de la maladie, lipiodol résiduel, iodisme.

4) Comme mesure pré-opératoire, la bronchographie peut être aussi importante que la bronchoscopie.

5) La bronchographie est particulièrement utile dans la localisation des lésions, dans la mise en évidence de dilatations tuberculeuses des bronches segmentaires et de quelques fistules broncho-pleurales; et pour distinguer l'un de l'autre le lobe rétracté et le lobe atélectasié.

6) L'examen bronchoscopique négatif n'élimine pas la bronchite segmentaire.

7) La majorité des lésions atteint le segment postérieur du lobe supérieur et le segment apical du lobe inférieur.

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Complications of Pneumothorax and Pneumonolysis*

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The following critical analysis is based upon the study of 132 cases of pneumonolysis performed on 110 patients on the Louisiana State University Thoracic Surgical Service. Although the number is small in comparison to those reported by Kunstler,[8] Moore,[11] and Bayliss,[6] it covers only a three year period, 1946-1948, and from a service which comprises 40 per cent of the available tuberculous (600) beds at Charity Hospital in New Orleans.

In so far as possible, all cases were followed for at least six months. Sixteen additional cases were performed during this period, but were not included, because six full months had not elapsed since thoracoscopy or pneumonolysis. Pneumonolysis in itself only converts an unsatisfactory pneumothorax to a satisfactory one. The patient is still subject to the everpresent complications that may result from pneumothorax.

The main objective of pneumothorax in the treatment of pulmonary tuberculosis is to secure adequate collapse, selective if possible, of the diseased lung. Frequently this is prevented by the presence of pleural adhesions. This was noticed early in the history of pneumothorax by Forlanini, who in 1894, wrote that "The pleural adhesions limit the volume of the pneumothorax and its curative value."[7] Matson said that 40 per cent of his failures were due to pleuritic adhesions.[14] In Alexander's series, 20 per cent of failures and 42 to 50 per cent of inadequate collapse were due to adhesions.[7]

It was obvious then that some attempts be made by which the adhesions could be freed. In 1908 Friedrich divided adhesions through open thoracotomy.[7] This procedure was practiced for a number of years, but was abandoned because of the extremely high incidence of serious complications. The operation of closed intrapleural pneumonolysis was first devised by Jacobaeus in 1913, and reported in 1915.[10] Unverricht published his results in 1922.[7] Since that time there have been many reports of the results of pneumonolysis. Among those of special interest are Anderson and Alexander (1937),[7] Burk (1938), Edwards and Lynn (1939), Carp and Kornbleth (1942), Goorvitch (1943)[13] and Kunstler (1948).[8]

Technique: The original technique as introduced by Jacobaeus

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was of the two cannula type, and employed the galvano-cautery as the cutting agent. Lately, there have been several advocates of the single cannula and the high frequency electrosurgical cutting knife. O'Brien in this country is the greatest exponent of the one cannula technique.[12] However, by far the majority employ the two cannula technique with the galvano-cautery. The advantages of the two cannula technique greatly outnumber those of the single type. These have been stated by Bayliss in great detail.[6]

Formation of Adhesions: Many individuals have discussed the formation of adhesions, but none more plausibly than Brock. The parietal pleura, which normally is thin, as a result of chronic inflammation becomes extremely thickened. The degree to which this thickened layer will stretch determines the structure of adhesions as found in artificial pneumothorax. If the disease is seen early, before the period of extensive fibrosis occurs, pneumothorax will stretch the adhesions. If seen late, when the inflammatory process becomes chronic, the ability of the pleura to stretch is much lessened and frequently, pneumothorax cannot be instituted as the pleural space is entirely obliterated. Several stages may be found in a single broad fan type adhesion. One area may be thin as the result of stretching—gradations of thickness may occur, and the lung may be pulled out to the chest wall in another area. Thus the type of adhesion cannot really be accurately determined prior to thoracoscopy.

Suitability of Adhesions for Division: One can only estimate the suitability of adhesions for division by vizualization through Fluoroscopy and multiple views of the lung fields. However, accurate determination can only be made by inspection through the thoracoscope. One of the prerequisites for the proceure of pneumonolysis is that there should be pneumothorax of sufficient size so that adequate space for the intrapleural manipulation of the thoracoscope is present. This should always be insisted upon. Another *must*, is that the patient should have been fluoroscoped or a roentgenogram taken a day or two before the procedure is attempted. All too often one relies on films that have been taken a month or so prior to the attempt at pneumonolysis.

A single firm adhesion may be the responsible factor in preventing adequate collapse. On the other hand numerous small thin strands may be responsible. Alexander[7] states that in his experience, significant adhesions are usually attached to the lung close to the lesions that demand better collapse. It is likewise true that an apical adhesion will frequently prevent the collapse of a cavity which is in the subapical area of the lung. Adhesions that are attached to lobes which are not involved by the disease process, usually will not prevent the collapse of an upper lobe. Those that

are viewed fluoroscopically as moving with respiration, usually will not prevent adequate collapse of the lung. Adhesions which are shorter than 2 cm. are rarely suitable for division, especially if they are in the mediastinal apical region. Furthermore, it is extremely difficult to estimate the length of an adhesion roentgenographically. The majority of lesions which are severed measure from 2 to 6 cm. in length—although it must be admitted that when an adhesion is longer than 4 cm., it usually does not interfere with adequate collapse.

Oblique roentgenograms often are of value in visualizing the extent of the adhesions. This was first demonstrated by Haight and Peirce.[7] What may appear radiologically to be isolated cords may be nothing more than multiple ridges in a single large adhesion. Many adhesions may be hidden by the lung and are only demonstrated thoroscopically. What may also seem to be a single cord like adhesion may prove to be a ridge on the parietal pleura.

No record of our preoperative predication as to whether or not the adhesions could be cut was kept in this series. However, it is interesting to follow the accuracy of the prediction as was done by Anderson and Alexander.[7] In their group an attempt was made before operation to estimate from a study of the roentgenograms the probable success in the division of the adhesions. The chances of success were considered good in two of the 24 cases in which the adhesions were actually found unsuitable for division, fair in seven, questionable in 14 and poor in one. The preoperative prediction in the 46 cases whose adhesions were incompletely divided was good in 11, fair in 14, questionable in 18 and poor in three. The preoperative prediction in the 41 cases whose adhesions were completely divided was good in 25, fair in 10, questionable in six and poor in none. Thus, it has been shown that a fair degree of successful prediction can be accomplished preoperatively. The degree of successful prediction increases in direct proportion to the experience of the surgeon.

It is a known fact that relatively few pneumothorax patients have adhesions that are suitable for intrapleural pneumonolysis. The reported use of the procedure in over 25 per cent of the patients with pneumothorax is considered too high by Alexander, who reports a considerably lower percentage.[7] It is his opinion that many of these cases would have obtained satisfactory pulmonary collapse from a more prolonged trial of unaided pneumothorax or from phrenic crush. This view is still held by many surgeons, although there is considerable tendency of late to attempt thoracoscopy and pneumonolysis early in the period in which pneumothorax has been instituted, and if the adhesions are found to be unsuitable for division, the pneumothorax should be aban-

doned and thorocoplasty performed. This latter view is a somewhat radical departure from those previously held, and has developed as a result of the many complications that do occur with prolonged pneumothorax. Probably a point of view midway between the two would be a more ideal approach.

Operation: The details of thoracoscopy and the lysis of adhesions will not be discussed. The procedure has been excellently described many times, however, it is of utmost importance to emphasize some points in the preoperative preparation of the patient. Intrapleural fluid that may be present should be aspirated, so that it will not come in contact with the area in which the adhesions are to be cut nor with the thoracoscope. It is also essential that a pneumothorax refill be given within a few days prior to the operation so that the width of the pneumothorax space be as great as possible at the time the cannulas are introduced. This is extremely important because on many occasions the amount of pneumothorax has decreased since the last roentgenogram. Therefore it should be the policy on all thoracic services that a roentgenogram be taken the day before operation. A roentgenogram is more important to the surgeon than fluoroscopy. On many services such as ours, the surgeon seldom sees the patient until pneumonolysis is considered. Therefore, he rarely has the opportunity to view the chest under the fluoroscope.

There are many types of preoperative medication in use, but as this procedure is performed under local anesthesia, a small amount of opiate and barbiturate usually suffices. The position of the patient varies with individual surgeons. It is our feeling that this is a matter of individual preference. We prefer the supine position, with side involved slightly elevated on a sand bag.

At the conclusion of the procedure of thoracoscopy and lysis of the adhesions, it is necessary that more air be instilled into the pleural cavity in order to maintain the preoperative degree of, or to increase the collapse. A procedure that does much to help this is to withdraw the last cannula in a mid-inspiratory phase of respiration. Thus, this increases the collapse and allows several hours, in which the patient can be fluoroscoped and more air instilled if necessary. On the other hand if the collapse is too great, air can be removed until a satisfactory collapse is established. When the cannulas are removed firm massage of the intercostal muscle bundle at the sites of the trocar openings will prevent extensive escape of air into the subcutaneous tissues.

Postoperatively the patient is placed in a semi-upright position, until fluoroscopy has established the fact that the collapse is satisfactory. If the subcutaneous emphysema seems to be spreading, it is wise to fluoroscope daily, in order to determine whether

adequate collapse is maintained. This is performed until the leakage of air stops. Excessive coughing should be controlled by opiates, so as to decrease the amount of air forced into the chest wall.

Complications: Although the operation may have been completely successful from the technical point of view, postoperative complications which may follow often make what seemed to be a successful procedure an eventual failure. The most common serious postoperative complications are tuberculous empyema and the mixed tuberculous and pyogenic empyema. The incidence of serious postoperative complications is in almost direct ratio to the shortness of the adhesion severed and in inverse ratio to the experience, skill and patience of the surgeon.

The type of complications that occur postoperatively and the varied interpretations of these makes it extremely difficult to compare end results of various authors. The bolder a surgeon gets, the higher will be the incidence of serious complications. This view is frequently stressed.[1-7,8]

Hemorrhage: From the severed ends of an adhesion, accidental cauterization of one of the major vessels in the pleural cavity and trauma to the intercostal vessels from introduction of the cannuli can occur. If this happens at the time of division of the adhesion an attempt should be made to further coagulate the severed end. If this fails, thoracotomy should be performed and the bleeding vessel ligated. Jacobeus reported two severe hemorrhages in 200 cases.[10] Others have reported similar complications.[6,11,13] Alexander states that in his experience it has never been necessary to do a thoracotomy to control the bleeding.[7] There have been two such complications in our experience. One was controlled by conservative measures. This patient later developed an obliterative pleuritis and the pneumothorax was abandoned. The second case of hemorrhage necessitated a thoracotomy. This patient has been followed for two and one half years. Her pneumothorax is still being maintained and except for a minimal amount of fluid, there have been no further complications.

Injury to nerves: May be caused by the introduction of cannulas. This is extremely rare. It is possible that in the division of adhesions at the apex of the pleural cavity and adjacent to the mediastinum that branches of the brachial plexus or the phrenic nerve may be injured. Isolated cases have been reported by Rosal and Carolpo and Schroder.[7] Where a single cannula for visualization and cauterization is used, the intercostal nerves are more apt to be injured because of the larger size of the cannula. This type of complication has not as yet been encountered on our service.

Emphysema of the chest wall in the region of the trocar punctures occur in practically all cases. On rare occasions emphysema

may be extensive. This is usually due to unusual paroxysms of coughing. If emphysema increases, one can tightly strap the chest over the trocar puncture sites. This usually controls the escape of air. The emphysema may be held to a minimum by the procedure previously mentioned. There were no cases of severe emphysema of the chest wall in this series.

Serous pleural exudate probably occurs in the majority of cases which have undergone thoracoscopy and lysis of adhesions. In most cases this does not persist for a prolonged period. The amount of serous pleural exudate that occurs we believe is directly proportional to the number and size of the adhesions divided. However, in our 132 cases, there were 56 or 42.4 per cent who developed serous fluid. Of these, eight ultimately developed pure tuberculous empyemas and three mixed tuberculous and pyogenic empyemas.

Pure tuberculos empyema is a relatively infrequent complication of pneumonolysis. Moore reported an incidence of 8.07 per cent in 2,043 collected cases.[11] This complication is apt to occur as a result of pleural contamination following division of an adhesion which contained pulmonary tissue.[9] It may not occur until days or weeks have elapsed. Treatment is conservative, namely: aspiration, instillation of antibiotics and air replacement. If these measures fail within an adequate trial period, thoracoplasty is indicated. In our series this complication occurred in eight cases or 6.1 per cent.

Mixed empyema rarely occurs. It may develop almost immediately following pneumonolysis or somewhat later. Moore reported an incidence of 1.8 per cent.[11] When it occurs early it probably indicates that a portion of infected lung or a superficial cavity had been directly opened. The treatment of this complication is to attempt sterilization of the pleural cavity; and maintainence of the pneumothorax. If this cannot be done within a relatively short period of time, open drainage should be instituted, to be followed by thoracoplasty. Mixed empyema occurred in three cases in our series, an incidence of 2.2 per cent. Two of the patients expired shortly after they developed this complication, and the third one developed bronchopleural fistula which was recognized five weeks following lysis of adhesions.

It is virtually certain that obliterative pleuritis occurs more frequently after the operation of intrapleural pneumonolysis, than during the course of pneumothorax, uncomplicated by surgery. Anderson and Alexander reported an incidence of 3.6 per cent in 111 cases.[7]

Partial or complete reexpansion of the lung because of obliterative pleuritis occurred in 39 cases or 29.5 per cent, an unusually high percentage. Of the 39 cases developing obliterative pleuritis

27 were associated with serous pleural exudate. In this group there were 25 cases in which the pneumothorax was abandoned as a result of the obliterative pleuritis.

Results: In order to have a common basis for comparison, we felt that results should be evaluated in a similar manner. Therefore we have selected a method of evaluation which has been used by others.[7,8] Our cases cover a three year period extending from January 1946 through 1948. At the outset, we admit that some of our cases are too recent, and that some results which we consider good at the present time may eventually be placed in the group considered as not completely satisfactory. However, all cases are at least six months postoperative.

1) Technical success in the division of the adhesions. Complete technical success does not necessarily mean a satisfactory result. Some cavities will not close even with almost total collapse of the side involved. Therefore the patient becomes subject to the complications which may arise as the result of prolonged pneumothorax.

Of the 132 cases of pneumonolyses performed during this period 65 or 49.3 per cent had complete technical success in that the adhesions were completely divided. Fifty eight or 43.9 per cent had incomplete pneumonolysis, either the adhesion was partially divided or not all of the adhesions were divided. Some of these were complete technical failures, because at thoracoscopy, the adhesions were not considered suitable for division. Four of these last group of cases were subsequently divided after further pneumothorax. The remaining five are of interest, in that in case 1, the collapse was ineffective, and the lung was allowed to reexpand. The disease process appears static at the present time. In case 2, the adhesions were still present, but the collapse was therapeutically good, and pneumothorax is still being maintained. Case 3, pneumothorax is satisfactory, and is being maintained, however he has developed pleural fluid, which requires frequent taps. Case 4, pneumothorax abandoned, and the lung reexpanded. Disease is progressive and patient has been discharged to bed-rest at home.

TABLE 1

Total Number Thoracoscopic Examinations	132
Number of Patients Thoracoscoped	110
Number of Pleural Cavities upon which Pneumonolysis was Performed	112
Number of Patients having Pneumonolysis Both Pleural Cavities	2
Number of Patients with Two Pneumonolysis	18
Number of Patients with Three Pneumonolysis	2

Case 5, pneumothorax unsatisfactory, lung reexpanded, disease is progressive. Patient discharged to bed-rest at home.

2) The effect of the operation upon the lung of the side operated. The effect of operation upon the lung and pleura of the operated side depends not only upon the degree of success in dividing the adhesions, but also upon any complication that may occur, and upon a completely satisfactory pneumothorax. Fifty six of these cases developed serous fluid following pneumonolysis. Eight developed tuberculous empyema, and three had mixed tuberculous and pyogenic empyema. Thirty nine cases developed obliterative pleuritis, and of these 27 had associated serous fluid. In this group, pneumothorax was abandoned in 25, two cases developed bronchopleural fistulas following pneumonolysis which resulted in their death. One died on the third postoperative day and the second died in the second postoperative week. One case developed a bronchopleural fistula, with a mixed tuberculous and pyogenic empyema as a complication. Seven who had been submitted to thoracoscopy and had division of the adhesions died of the disease within our period of observation. The immediate effect of operation upon the lung and pleura of operated side were classified as improved in 66, disease process increased in 25, and no effect in 19.

One must not believe that complete technical success implies excellent results directly attributed to pneumonolysis. As we have stated previously ensuing complications can alter a complete technical success. Because of this our cases were further analyzed as to the late results—six months or more after pneumonolysis. In 60 of the 110 cases regardless of technical success satisfactory pneumothorax was maintained, three cases had unexpandible lungs, but the pneumothorax was satisfactorily maintained. One case

TABLE 2

Author	Total Number of Cases Thoracoscoped	Complete Pneumonolysis Cases	Incomplete Pneumonolysis Cases	Complete Technical Failure Cases
Anderson and Alexander	111	41 (37.0%)	46 (41.4%)	24 (21.6%)
Edwards and Lynn	255	86 (34.0%)	140 (55.0%)	29 (11.0%)
Carp and Kornblith	100	32 (32.0%)	43 (43.0%)	25 (25.0%)
Kunstler	597	235 (39.4%)	306 (51.2%)	56 (9.4%)
Matson	249	154 (61.9%)	19 (7.5%)	76 (30.5%)
Louisiana State University	132	65 (49.3%)	58 (43.9%)	9 (6.8%)

later had decortication of the unexpandible lung with excellent reexpansion. Pneumothorax was abandoned in 33 cases for various reasons, such as obliterative pleuritis and failure to obtain satisfactory pneumothorax. An adequate pneumothorax was maintained in four of the cases which were classed as complete technical failures. One case with only a partially satisfactory pneumothorax had tremendous improvement in the disease process, and was discharged from the hospital to bed-rest at home. Two cases deserted 13 and 18 days respectively following pneumonolysis so that an adequate follow-up was impossible. Of the 33 cases in which pneumothorax was abandoned, six had subsequent thoracoplasty. Three additional cases were advised to have thoracoplasty but refused. One case had right upper lobe lobectomy and one right pneumonectomy. In spite of a satisfactory pneumothorax, 12 cases had an increase in the extent of the disease and were discharged to bed-rest at home.

There was little or no effect upon the contralateral lung following pneumonolyses. Eleven cases showed some increase in disease in the contralateral lung.

Discussion: The desire to secure a collapse procedure in the treatment of pulmonary tuberculosis, which in effect would not be irreversible, has led most pthisiologists to rapidly discard pneumothorax and pneumonolysis. In its place has been substituted pneumoperitoneum with or without phrenic crush. From the results thus far obtained, it would seem that pneumothorax is at

TABLE 3

Immediate Effect of Operation Upon the Lung and Pleura of Operated Side

Improved	65
No Effect	19
Disease Process Increased	25
Disease Process Increased in Contralateral Lung Following Pneumonolysis	11

TABLE 4

Complications

Accumulation of serous fluid Following Pneumonolysis	56
Tuberculous Empyema	8
Mixed Empyema	3
Obliterative Pleuritis	39
Spontaneous Pneumothorax	2
Bronchopleural Fistula	1
Died	7

best an unsatisfactory procedure in comparison with pneumoperitoneum. Complications which would prevent reexpansion of the lobe or lung involved are rarely seen. However, it too has many disadvantages, principally in that selective collapse of the involved area cannot be accomplished, without compression of basal segments of the lower lobe just above the diaphragm.

What has caused the present unpopularity of pneumothorax? Our study only confirms what has been previously stated many times. Prolonged pneumothorax, even if satisfactory, can be made unsatisfactory by the many complications that do occur. One cannot prognosticate when they will occur. A pneumothorax can be satisfactory for many months, and then suddenly develop pleural effusion, followed by obliterative pleuritis. Other complications, such as failure of the lung to reexpand after prolonged pneumothorax, has certainly added to the weight of evidence which has been piling up against this procedure for many years.

Can we attach any of the blame for the frequent failure of pneumothorax to faulty judgement in the selection of cases? We think we can. In the past, many cases have been selected for pneumothorax, which in the light of our present knowledge would be considered as unsuitable for such a procedure. However, we do not believe that it justifies complete abandonment of pneumothorax. Our accumulating experience with pneumoperitoneum has shown us that this procedure also has its disadvantages and limitations. It is becoming increasingly evident that pathology in the upper lobes—peripheral in location, frequently cannot be controlled by pneumoperitoneum with or without phrenic crush. However, it is generally admitted that this procedure certainly is not

TABLE 5

Evaluation of Cases—Six Months Post Pneumonolysis

Satisfactory Pneumothorax Maintained	60
Unexpandible Lung—Pneumothorax Maintained	3
Pneumothorax Abandoned	33
Complete Technical Failure—Pneumothorax Maintained	4
Discharged to Bed Rest—Decrease Disease—Partially Satisfactory Pneumothorax	1
Deserted After Pneumonolysis 13-18 Days	2
Died	7
Subsequent Thoracoplasty	6
Refused Thoracoplasty	3
Lobectomy	1
Pneumonectomy	1
Discharged To Bed Rest—Increased Disease—Satisfactory Pneumothorax	12

fraught with the many complications that endanger prolonged pneumothorax.

Does pneumothorax have any place left in our armamentarium against tuberculosis? We believe it does, but in order that the procedure of pneumothorax plus possible pneumonolysis, escape the reputation that it has acquired, we must be more careful in our exercise of judgement in the selection of cases. The suggestions of Kunstler can contribute a great deal toward the prevention of the relatively frequent complications. Particularly those in which pneumothorax should be immediately abandoned. They are worthy of repetition. "1) Important adhesions that are not suitable for cutting and other procedures (thoracoplasty, lobectomy, segmental resection, pneumonectomy) are possible, 2) fluid and high fever develop and persist for more than a few days, 3) conditions which predispose to the development of empyema are present, especially injury to the lung by the cautery, rupture of residual adhesions, or a cavity and extensive active disease of the lung, 4) oxygen consumption is below the minimum compatible with light exercise, 5) tension cavities are present."[8]

As evidenced in our series, the number of complications which developed were high, in spite of the fact that 65 or 49.3 per cent had what we consider complete technical success. In many cases pneumothorax was continued in spite of the warning signs of impending complications. Today these warning signs would cause us to readily abandon pneumothorax in favor of another type of surgical collapse.

Naturally we must also reconcile ourselves to the fact that fewer cases are being subjected to pneumothorax, because of the increasing popularity of primary thoracoplasty and pulmonary resection. Additional time will be needed for further evaluation of our results with lobectomy or segmental resection. This view has been repeatedly expressed by Chamberlain[15] and Overholt.[16]

CONCLUSIONS

Closed intrapleural pneumonolysis is a highly valuable procedure which has a definite place in surgical collapse therapy of pulmonary tuberculosis.

In well selected cases which show that the pneumothorax is unsatisfactory due to single or multiple adhesions, lysis of adhesions will convert it to a satisfactory one.

Suitability of adhesions for lysis can only be predicted with a fair degree of accuracy prior to thoracoscopy. Therefore, this should be performed in all cases of unsatisfactory pneumothorax where there is a possibility of division of the adhesions.

The percentage of complete technical failures in our series (6.8

per cent) is lower than in Kunstler (9.4 per cent), but this is probably because in recent years there has been a gradual trend toward the use of pneumoperitoneum and phrenic crush, so that fewer cases are having pneumothorax, therefore fewer cases for thoracoscopy.

Complications, resulting from pneumothorax and pneumonolysis are mainly those from prolonged pneumothorax, but are increased by thoracoscopy and lysis of adhesions. Of 110 cases, in whom thoracoscopy was performed 132 times, only 60 had satisfactory pneumothorax. In 33 cases pneumothorax was abandoned, six had subsequent thoracoplasty and two, major pulmonary resection. It is this high incidence of complications, which often render pneumothorax irreversible that has resulted in the loss of popularity of pneumothorax and pneumonolysis. Nevertheless it is a valuable procedure in well selected cases, and rightfully occupies a place in the surgical collapse therapy of pulmonary tuberculosis.

CONCLUSIONES

La neumonolisis intrapleural cerrada es un procedimiento muy valioso que ocupa un lugar bien definido en la colapsoterapia quirúrgica de la tuberculosis pulmonar.

En casos adecuadamente escogidos, en los que el neumotórax no es satisfactorio debido a adherencias sencillas o múltiples, la sección de esas adherencias convertirán el neumotórax no satisfactorio en uno que sí lo es.

Antes de la toracoscopia, la adaptabilidad de las adherencias para la lisis sólo puede predicarse con un grado mediano de exactitud. Por consiguiente, debe llevarse a cabo este procedimiento en todo caso de neumotórax no satisfactorio en el que exista alguna posibilidad de seccionar las adherencias.

El porcentaje de completos fracasos técnicos en nuestra serie (6.8 por ciento) es menor que en la serie de Kunstler (9.4 por ciento), pero esto probablemente se debe a que en los años recientes ha existido una tendencia gradual hacia el empleo del neumoperitoneo y la trituración del frénico, de manera que menos casos reciben neumotórax y, por lo tanto, menos casos se someten a la toracoscopia.

Las complicaciones que siguen al neumotórax y a la neumonolisis son principalmente las complicaciones del neumotórax prolongado, pero las aumenta la toracoscopia y la sección de adherencias. En 110 casos en los que se ejecutó 132 veces la toracoscopia, sólo 60 casos tenían neumotóraces satisfactorios. Se abandonó el neumotórax en 33 casos, seis de los cuales fueron sometidos subsecuentemente a toracoplastías y dos a resecciones pulmonares mayores. Esta alta frecuencia de complicaciones, que a menudo convierte el

neumotórax en un procedimiento irreversible, es lo que ha causado la pérdida de popularidad al neumotórax y a la neumonolisis. Sin embargo, en casos debidamente escogidos, éste es un procedimiento valioso que merece el lugar que ocupa en la colapsoterapia quirúrgica de la tuberculosis pulmonar.

RESUME

La pneumolyse intrapleurale est un procédé de haute valeur, qui a une place déterminée dans la collapsothérapie chirurgicale de la tuberculose pulmonaire.

Dans des cas bien déterminés, quand le pneumothorax n'est pas satisfaisant, par suite d'une ou plusieurs adhérences, la section de ces adhérences le transformera en pneumothorax efficace.

Ce n'est qu'après pleuroscopie qu'on peut dire avec certitude que la section de brides est réalisable. C'est pourquoi la pleuroscopie doit être faite systématiquement dans tous les cas de pneumothorax non satisfaisants.

Le pourcentage des échecs techniques dans nos observations (6,8%) est plus faible que celui de Kunstler (9,4%). La cause en est, sans doute, que depuis ces dernières années, il y a eu une tendance progressive à pratiquer le pneumopéritoine et la paralysie du nerf phrénique, si bien qu'il y a moins de cas de pneumothorax, et par suite moins de cas de pleuroscopie.

Les complications résultant du pneumothorax et de la section de brides sont pratiquement les mèmes que celles du pneumothorax prolongé, mais elles sont encore accrues par la pleuroscopie et la section de brides. Sur 110 cas, dans lesquels la pleuroscopie fut pratiquée 132 fois, il y eut seulement 60 pneumothorax satisfaisants. Dans 33 cas, le pneumothorax fut abandonné, ultérieurement 6 furent l'objet d'une thoracoplastie et 2 d'interventions d'éxérèse. C'est cette grande fréquence de complications rendant souvent le pneumothorax irréversible, qui a eu pour conséquence l'impopularité du pneumothorax et de la pneumolyse. Néanmoins, c'est un procédé de valeur dans des cas bien déterminés, et qui occupe à juste titre une place dans la collapsothérapie chirurgicale de la tuberculose pulmonaire.

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Kartagener's Triad

Review of the Literature and Report of a Case*

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In 1904, Siewert[1] reported a case of situs inversus with bronchiectasis in a 21-year-old white male. Guenther,[2] in 1923, described situs inversus and bronchiectasis in a 19-year-old girl who had two normal siblings, but a third sibling had situs inversus and "bronchial catarrh." Subsequently, in 1933, Kartagener[3] added 11 cases of situs inversus and bronchiectasis, all of which also presented findings of chronic sinusitis. The association of these three abnormalities has since become known as Kartagener's Triad. Approximately 40 cases have been described in the literature to date.[1-13]

The following case is presented because this patient is older than any heretofore reported, and because he exhibited a host of other pathological conditions, some of which may be related to the aforementioned group of abnormalities.

Case Report

A 63-year-old white male veteran of World War I was admitted to the hospital complaining of recurrent episodes of pain, redness, and swelling of his joints of 10 months' duration. He had had intermittent involvement of both knees, shoulders, elbows, wrists and of the small joints of both hands.

Past history revealed a chronic cough as far back as he could recall, unusual susceptibility to colds during childhood, and left otitis media at age 18. In 1918, he had acute sinusitis which was treated over a seven-month period with intranasal instillations of argyrol. Shortly thereafter, he developed a bluish discoloration of the skin. Following this acute episode of sinusitis, the cough became productive of about one cupful of purulent sputum daily. He claimed to have had numerous episodes of pneumonia during the past 30 years. His mother had had diabetes and one brother died of diabetes at age 13.

Physical examination revealed a well-developed, moderately obese, left-handed white male, who did not appear ill. Blood pressure 140/96, pulse 78, temperature 98.4 degrees Fahrenheit. There was bluish discoloration

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of the skin of the face, hands and scalp and purplish brown discoloration of the bulbar and palpebral conjunctiva. Bilateral pterygia were present. A firm, non-tender mass, 1 centimeter in diameter, was noted in the buccal mucosa opposite the lower right first molar (subsequently excised and found to be sub-epithelial fibrosis). The nasal mucosa was edematous, and thick mucopurulent discharge was noted on the nasal floor. There was dullness to percussion and diminished breath sounds over the right lung base posteriorly. Loud, high-pitched rhonchi were heard throughout the remainder of the lung fields. The left diaphragm was

FIGURE 1

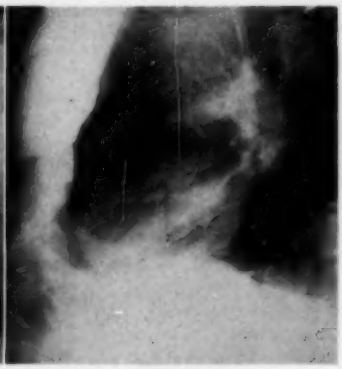

FIGURE 2

Figure 1: Transposition of heart and aorta. Atelectasis of basilar segments of right lower lobe.—*Figure 2:* Atelectasis of basilar segments of right lower lobe visualized behind the heart.

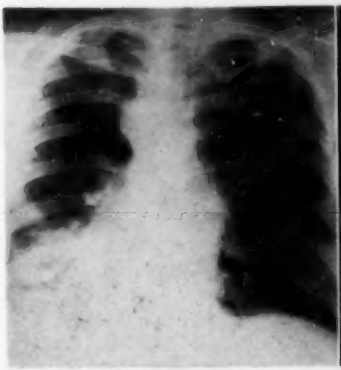

FIGURE 3

FIGURE 4

Figure 3: Chest film made two years earlier than Figure 1. Large dilated air-containing bronchi can be seen in the area of pneumonic consolidation of the right lower lung field.—*Figure 4:* Bronchogram showing cylindrical and saccular dilatation of basilar bronchi.

higher than the right, but both moved adequately with respiration. The heart was percussed in the right hemithorax and was apparently of normal size. Liver dullness was percussed on the left. There was fusiform swelling of the proximal interphalangeal joints of the index and middle fingers of both hands. There was some pain on motion of all the joints of the upper limbs and of the large joints of the lower extremities. The prostate was moderately symmetrically enlarged and tender.

Complete blood count and urinalysis were normal. Sedimentation rate (Wintrobe, corrected) was 38 millimeters per hour. Sputa were negative for tubercle bacilli and positive for Streptococcus viridans, Neisseria catarrhalis and Friedlander's bacillus. Standard electrocardiogram revealed typical "mirror image" tracing of dextrocardia.

Chest fluoroscopy revealed the cardiac shadow in the right hemithorax. The aorta was also on the right side. A triangular shaped density in the right lower lung field was thought to represent atelectasis of the right lower lobe (Figures 1 and 2). Bronchograms made elsewhere two years previously revealed extensive saccular and cylindrical bronchiectasis in the basilar segments of both lower lobes (Figures 3 and 4). Sinus films revealed cloudiness of all sinuses except the sphenoids (Figure 5). Gastrointestinal studies revealed complete transposition of the abdominal viscera (Figures 6 and 7). Films of all large joints and hands did not show

FIGURE 5: Clouding of frontal sinuses with sclerosis and blurring of the sinus margins.

conclusive radiographic evidence of rheumatoid arthritis.

At bronchoscopy, the larynx and trachea appeared normal. On the right, only upper and lower lobe bronchi could be identified. Three divisions of the left main stem bronchus were seen. The bronchial mucosa was reddened, edematous and bled easily. Profuse mucopurulent secretion was present in both bronchial trees, most abundant in the right lower lobe bronchus.

Surgical treatment was not considered advisable because of the extensive involvement and because of the patient's age. He was, therefore, treated medically with penicillin inhalations and streptomycin intramuscularly. Marked relief of cough followed and sputum was reduced from 240 cubic centimeters to 30 cubic centimeters daily.

Salicylates and physiotherapy gave partial relief of joint symptoms.

Discussion

Siewert, in his original paper, speculated on the possible congenital etiology of bronchiectasis because of his observance of this condition in a patient who had congenital transposition of viscera. Proponents of the congenital origin of bronchiectasis have since enlarged upon this interesting observation, and subsequent reports of additional cases have been used to lend further support to this theory.

Adams and Churchill[4] added to the literature five cases ranging from nine to 28 years of age. They observed that in 23 cases of situs inversus, five (21.7 per cent) had bronchiectasis; whereas, only 0.306 per cent of approximately 240,000 general hospital ad-

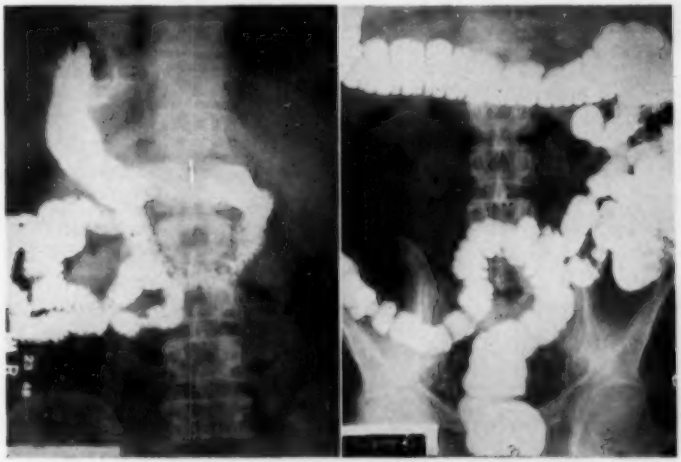

FIGURE 6 FIGURE 7

Figure 6: Transposition of upper GI tract.
Figure 7: Transposition of colon.

missions had bronchiectasis. According to Mallory,[5] this high incidence of bronchiectasis in situs inversus may be accepted as indirect evidence in support of its congenital origin. Ingraham[6] reported a case of Kartagener's Triad in whom multiple bilateral lobectomies were performed. The tissue was examined by the pathologist, who stated, "The entire picture strongly suggests a congenital malformation with persistence of peribronchial connective tissue and underdevelopment of alveolar structures." The observance of ectatic bronchi in infants shortly after birth may be accepted in support of the congenital theory. The occurrence of this disease in twins may also be used to strengthen this hypothesis.[7]

Richards[8] reports the case of a child with situs inversus, who from the age of five days was treated for nasal obstruction and cough, and who at the age of seven years showed x-ray evidence of sinusitis and bronchiectasis.

In a discussion of the genetics of the transposition of visecra, Cockayne[9] presents evidence which he accepts as proof of the hereditary nature of this condition, and states that it is due to a rare recessive character. He claims that all organs are originally bilaterally symmetrical and change to spiral symmetry in the process of dextrorotation. In cases of situs inversus, the rotation is sinistral. He feels that, because malformations of the heart and bronchiectasis are more common in transposition of the viscera, the gene which produces sinistral rotation carries with it a greater liability to early death than does its dominant allelomorph for normal rotation.

Whether or not the evidence cited above is significant statistically to support the theory of congenital origin of bronchiectasis is debatable. Rosenthal,[10] after his review of the literature, feels that there is insufficient evidence to support the assumption that a direct relationship exists between the anomaly of visceral transposition and bronchiectasis.

Unfortunately, a study of cases of Kartagener's Triad does not resolve the question as to whether the basic anomaly in congenital bronchiectasis is abnormal dilatation or abnormal structure of the bronchial wall present at birth and more easily attacked by recurring respiratory infections.

Practical consideration must be given to the observed high incidence of bronchiectasis in patients with situs inversus. This would include the use of all available prophylactic measures to prevent recurrent respiratory tract infections. In children with transposition of the viscera and a history of respiratory tract infections, early bronchography is recommended so that if bronchiectasis is present therapeutic measures may be instituted at once.

SUMMARY

1) A case exhibiting the typical features of Kartagener's Triad is reported.

2) The literature is reviewed and some of the bases of the congenital origin of bronchiectasis are discussed.

3) Attention is called to the need for early and vigorous efforts to prevent recurrent respiratory tract infections in patients with situs inversus.

RESUMEN

1) Se informa sobre un caso que exhibió los rasgos característicos del Terno de Kartagener.

2) Se repasa la literatura y se discuten algunas de las bases de la teoría del origen congénito de la bronquiectasia.

3) Se llama la atención sobre la necesidad de hacer esfuerzos tempranos y vogorosos para evitar repetidas infecciones del aparato respiratorio en pacientes con *situs inversus*.

RESUME

1) L'auteur rapporte un cas typique de syndrome de Kartagener.

2) Il passe en revue la littérature et discute quelquesunes des bases de la théorie de l'origine congénitale de la bronchiectasie.

3) Il appelle l'attention sur la nécessité d'empêcher par des mesures énergiques et précoces les infections répétées de l'appareil respiratoire chez les malades avec inversion des viscères.

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Tuberculosis and *Private* Health

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The contributions that public health authorities and associated agencies have made in the control of tuberculosis are both well recognized and well publicized. Tuberculosis has reached a new minimum death rate of 25.1 per 100,000 for the first three-quarters of 1949.[1] Although the factors that are responsible for such a low tuberculosis death rate are many and complex, there can be no doubt that the control of the disease by public health agencies has been a material factor in this gratifying decline. From the standpoint of the private physician, particularly one who has a special interest in tuberculosis, the recent and more accelerated public health measures for controlling the disease are not without their hazards and disadvantages. Within the past generation, tuberculosis has definitely become less the problem of the individual physician and more the concern of various groups, official and unofficial, lay and medical, trained and only partly trained.

This displacement of the private physician from any responsibility or interest in tuberculosis is a significant consequence of the modern tendency of relegating the control of this disease to institutional staffs or health organizations. One problem that such a diversion of patients creates is its failure to provide for the education of our future doctors regarding both the diagnosis and management of tuberculosis. House officers, even those who are trained on superior medical services of large general hospitals, are likely to leave their training with no more of a concept about the disease than to order a chest x-ray film and to hurry the patient off to a sanatorium. For many of them, this lack of training brings with it an unfamiliarity with the nature of tuberculosis or with the multitude or magnitude of the problems of its victims. For these inadequately trained physicians, tuberculosis is a disease whose treatment must be relegated to others, even if the diagnosis has been established by them.

As a result of this deficiency in training, errors of inclusion and errors of exclusion are made. For example, patients with bronchiectasis or lung cancer are "sanatoriumized" without adequate study when the illness is diagnosed as tuberculosis on the basis

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of symptoms and x-ray findings. In my own experience, I have seen patients admitted once or twice to the sanatorium because tuberculosis was suspected, and each time sputum tests failed to reveal tubercle bacilli. Bronchography revealed bronchiectasis. I have seen some of these patients admitted for the third time with a change in the radiological appearance of their chest and the presence of tubercle bacilli in their sputum. Although it can be argued that pulmonary tuberculosis might have been present and missed on the first or second earlier admissions to the sanatorium, one can not escape entirely the uneasy feeling that these patients may have been infected during their first or second contact in the institution.

This zeal to segregate patients can result in other tragic errors. For example, not long ago a 21-year old colored girl was admitted to a large general hospital because of symptoms suggestive of atypical pneumonia. The house officer who admitted her believed he heard rales at the right apex and had her isolated in a small four-bed ward next to a patient with far-advanced pulmonary tuberculosis. This young Negress remained in close proximity to an open case of tuberculosis pending x-ray and laboratory studies. The x-ray films of her chest proved to be entirely negative. The rales, previously reported, could not be heard during the next and subsequent days. As a matter of fact, repeated tuberculin tests were also negative. Nevertheless, about one week elapsed between this patient's admission and discharge from her isolation room. It is conceivable, if not likely, that tuberculous infection may have been acquired in this brief but intimate and intensive exposure to the disease. Apical rales do not necessarily mean active tuberculosis. Isolation of a patient under the circumstances described above, is definitely detrimental and results from over-zealousness and lack of understanding of the nature of tuberculosis.

As far as cancer of the lung is concerned, the need for careful differential diagnosis has been discussed by myself[2] and others.[3] From such experiences, it might be estimated that annually at least 100 patients are hospitalized in various institutions throughout the country on the basis of an erroneous diagnosis. Such errors in diagnosis would be less likely to happen if the individual physician were better acquainted with the manifestations of tuberculosis and the diseases which it simulates.

This deficiency in the modern training of the doctor in regard to tuberculosis was criticized by me[4] a few years ago, and more recently by Muschenheim.[5] According to the latter, tuberculosis "is the most important among the diseases which are both preventable and curable." Muschenheim notes that tuberculous patients who might otherwise serve for clinical instruction have, for

the most part, been withdrawn from teaching hospitals and segregated into sanatoriums that are relatively distant from teaching centers. "Consequently," he says, "neither the students nor their principle teachers have sufficient opportunity for direct observation and study of this prevalent disease." He advocates that tuberculous patients be admitted to general teaching hospitals on a more liberal basis and that even a small tuberculosis section in such hospitals, perhaps limited to 25 or 50 patients, would be of definite educational value. Such a plan of treatment would be an aid both to the internist, who has no special interest in tuberculosis, and to the phthisiologist who has a special interest in internal medicine.

There can be no question that the intensive segregation of tuberculosis patients over the past few generations has been a definite detriment to the training of the modern physician. Unless this situation is promptly corrected, interest in this disease among practitioners will even more rapidly wane and the disease will become entirely a problem to be handled by official and lay organizations. As a matter of fact, even at the present moment, the situation has so deteriorated that there are many social workers and physicians who believe that there are no individual physicians who are trained to treat the tuberculous. For them, tuberculosis is a disease to be feared, shunned, or ignored simply because of an unfamiliarity with the basic facts regarding its cause or management.

More disturbing than these considerations is the fact that in the zeal to promote so-called public health measures, the rights, privileges and liberties of the individual patient may be ignored or even violated. This point is highlighted in several recent articles. Exner[5] states, "The health officer is taught to believe that he knows better than anyone else what is necessary to protect people's health. He is vested with police power to protect people by force, if necessary, from the consequences of their own or other people's ignorance or folly. This is both necessary and proper but it is neither safe nor proper to grant him unrestricted power or to let him be sole judge of the public interest.

"Since the only other group trained to evaluate medical necessity consists of the practicing physicians, it falls upon them to take the lead in curtailing abuse of authority. The medical society, as the collective voice of the doctors, should fulfill this function but all too often it fails to do so. Sometimes it even goes so far astray as to permit the health officials themselves to speak for the medical society in matters of public health and thus to be, in effect, the censors of their own activities."

These facts apply particularly to tuberculosis control. I recall

one patient, a veteran of the first World War, who refused to give me a sputum sample for evaluation of his tuberculosis, simply because he and his family were "hounded to desperation" by public health authorities when the diagnosis was first established in his case 30-odd years ago. This patient was driven to the point of bankruptcy and had to assume a menial and laborious task upon his discharge from the sanatorium. He was afraid that if the diagnosis of tuberculosis was again established in his case, he would be similarly hounded. The possibility of such a situation was a most frightful and agonizing experience to him. Obviously even public health needs could better be served if the patient could be assured that his private physician had a warm, friendly and personal interest in him and his problems.

Howard[6] also states: "Unrestrained power within the hands of an individual, a group of ambitious but selfish men, or in a political party is a peril to freedom." Of all forms of unrestrained power, he believes that bureaucracy is probably the worst. In bureaucracy action is slow, responsibility diffused, decision uncertain and shifting. "Once a bureaucracy takes over," says Howard, "there is a gradual but certain deterioration of constructive progress with ultimate cessation of all individual contributions to the welfare of the State." Howard believes there has developed a mania for regulating people, most of which is beyond the ordinary necessity to protect individual rights and safeguard society. In a disease such as tuberculosis, such bureaucracy is becoming more and more evident not only in officially constituted agencies but also in lay organizations and auxiliary services.

This meddlesome interference in the private lives of individuals can be illustrated by several examples. Consider the patient whose financial circumstances are adequate and whose living conditions are ideal. Consider specifically the case of a 32-year old school teacher, both of whose parents are living and in good health but who are retired and at home. Such a patient on routine survey may be found to have minimal disease with either a negative sputum or a rarely positive sputum. Under the conditions described such a patient may be well able to receive the best rest and nursing care at home. If indicated, she might receive streptomycin given to her by a visiting nurse, and if also indicated, pneumothorax might be induced in a general hospital, and the patient allowed to continue her treatment at home and later on a semi-ambulant or ambulatory basis. Under the circumstances described, the patient's home life would not be violently disrupted and the psychological problems attendant to institutional living would not develop. If such a patient, however, attempted to follow the routine described above, she would very likely find herself under a variety

of pressures tending to have her placed in a sanatorium and under the care of institutional physicians. The wisdom or necessity of such pressure is questionable.

The advent of mass chest x-ray examination has increased still further the need for careful individualization of the patient's problems. It can not be repeated too often that shadows in the chest, even if they are apical, are not necessarily tuberculous. For example, consider the case of the 37-year old naval veteran who was hospitalized because a photofluorogram at the separation center in October of 1945, revealed a "shadow" at the apex of his right lung. He was asymptomatic. From October 1945 until August 1946, he was studied at several naval hospitals at which time sputum and gastric tests were constantly negative, sedimentation rates were normal and the lesion in his chest showed no change. Careful physical examination of this veteran revealed a deep scar just above the right clavicle, a residual from an old osteomyelitis. This scar coincided exactly with the apical lesion. It is likely that this veteran was hospitalized for 10 months for a disease which he did not have. The scar in the neck was misinterpreted as a scar in the lung. Furthermore, it is also likely that during hospitalization, he was exposed to infection which might subsequently lead to disease and disability.

The care with which x-ray films from mass surveys must be scrutinized has been recently commented upon by Albrecht.[7] This investigator believes that unless such surveys are properly carried out, repercussions of one sort or another may soon develop in the population at large. As a matter of fact, he believes that the general public may develop a phobia and fear toward being x-rayed. He emphasizes the importance of a good clinical history. "No community-wide chest roentgenographic survey," he says, "can be considered satisfactory unless it permits a correct diagnosis." Small films are not diagnostic, they are simply screening. Even the large 14 x 17 inch film should be supplemented by a good history and adequate physical examination. Albrecht believes there is need to reeducate some of the medical profession. Physicians nowadays recognize the limitations of the stethoscope. They should also be taught to recognize the limitations of the x-ray film. If Albrecht's views were more widely publicized, it is certain that less injustice would be done. Fewer patients with insignificant lesions would be hospitalized and hospital space would be saved for those who need it.

SUMMARY AND CONCLUSIONS

1) Because of the diversion of the care and treatment of cases of tuberculosis from private physicians and general hospitals to

official agencies and institutions, the modern doctor's training in the recognition and treatment of pulmonary disease suffers.

2) Because of the increased tempo associated with mass x-ray surveys and intensive attempts at the segregation of those with suspicious lesions, there is a real danger that the rights and privileges of individuals are likely to be brushed aside.

3) Victims of tuberculosis are people with feelings, friends and families. They are not cards that can be shuffled in a deck or pins to be placed on a map. Every effort must be made to treat these *sick* individuals as *individuals*.

RESUMEN Y CONCLUSIONES

1) Debido a que el cuidado y tratamiento de los tuberculosos ha pasado de los médicos particulares y hospitales generales a las agencias e instituciones oficiales, el doctor moderno no está bien preparado para reconocer y tratar las neumopatías.

2) Debido a la rapidez con que se llevan a cabo los catastros radiográficos colectivos y al esfuerzo enérgico que se hace para segregar a las personas que revelan lesiones sospechosas, existe un verdadero peligro de que se prescinda de los derechos y privilegios del individuo.

3) Las víctimas de la tuberculosis son personas que tienen sentimientos, amigos y familias. Ellos no son tarjetas que se barajen como naipes ni alfileres prendidos en un mapa. Se debe hacer un gran esfuerzo para que se trate a estos individuos *enfermos* como *individuos*.

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Address

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Ladies and Gentlemen:

Today marks the first anniversary of our emergence as a distinct group dedicated to the study of chest diseases. A review of the statistics has revealed that the mortality rate of uberculosis has slowly but steadily gone down. This should serve now more than ever as an impetus for us to hold the ground we have gained and to drive ahead with vigor. One of the ways in which the progress of tuberculosis control is being retarded is putting the emphasis upon accomplishments, not upon the unfulfilled tasks. To believe the job is nearly done is dangerous, and the facts should be faced. As Hinshaw says, "the control of tuberculosis involves acquiring new knowledge which is research; and distributing existing knowledge which is education. Education in turn involves the public as well as the medical profession." We should therefore—all of us—pool our resources so as to enlarge the scope of our activities not only in Manila where it seems to be centralized but also everywhere else in the Philippines. To accomplish this it is imperative that we should have men not only with acknowledged "know-how" but also funds and lots of it. I believe the Philippine Tuberculosis Society and the Quezon Institute have been doing their share in the task of preparing more and more physicians along lines of practical training in the management of chest diseases in general and tuberculosis in particular. I know also that our colleagues in the National Chest Center have been exerting parallel efforts towards the same end. It is discouraging to note however that the men we have trained are as a whole reluctant to spread out to the different corners of the Philippines and distribute evenly the blessings of modern scientific treatment. It seems that the siren call of adventure and of service has not been sufficiently attractive to wean them away from the conveniences of the city. But what they have not realized is the fact that there are many chest specialists who have carved a name for themselves

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and a fortune besides by abandoning the advantages of city life and settling in regions less glamorous perhaps but apparently more responsive in terms of financial returns than the City of Manila. In the City of San Pablo, our distinguished colleague and presently governor for the Philippine Chapter of the American College of Chest Physicians, Dr. Quisumbing, is evidently "master of all he surveys." In Batangas, Batangas, Dr. Senarosa is doing a splendid job. In Laoag, Ilocos Norte, there is Dr. Rizal Peralta; in San Carlos, Pangasinan, Dr. Vicente Samson; in Camiling, Tarlac, Dr. Santiago F. Lopez; in Tarlac, Tarlac, Dr. Teodosio Santos; in Cabanatuan, Nueva Ecija, Dr. Loreto Castro and in Cavite, Cavite, Dr. Manuel Legaspi. Their stories read like veritable odysseys of men determined to conquer, of pioneers refusing to be daunted by seemingly insurmountable odds, of physicians who bartered convenience for opportunity, of visionaries who sowed the seeds of tuberculosis consciousness in the minds of those apparently just waiting to be aroused from their apathy towards the White Plague, and thereby reaped the rich harvest not only of material emoluments but also the richer harvest of spiritual satisfaction in the full knowledge of a task well done.

But these eight pioneers added to the nine physicians we have handling our provincial pavilions and dispensaries in Vigen, Ilocos Sur; Tuguegarao, Cagayan; Legaspi, Albay; Rizzal City, Rizal; Iloilo, Iloilo; Capiz, Capiz; Cebu City, Cebu; Tacloban, Leyte; and Zamboanga City, Zamboanga, make only a total of 17, a little over a dozen men. Add to these the handful of men taking charge of the Bureau of Health dispensaries in the different provinces and we have less than two dozen. To spearhead a gigantic drive such as that envisioned by any anti-tuberculosis campaign we need more than just this number. We will need scores of men, perhaps legions even, unless we are reconciled to the idea of having our dreams of conquering the White Plague remain forever in the "blue-print" stage. You will, I hope agree with me, that there is a compelling necessity for us to try and have the ideals and objectives of our society disseminated within the widest possible arc so as to induce our brother physicians in remote towns to seak membership in our society the *hard way*—the way of specialized training in the management and control of tuberculosis. If we would but take time out in our daily chores and ponder over the vast economic waste entailed by patients who have to be brought to Manila all the way from their home town, hundreds of kilometers away, because of the lack of competent specialists in the area where they reside, you will readily realize what tremendous savings our people can effect if instead of their coming to us we go to them.

Perhaps I am being idealistic, and the idealist they say is seldom practical. But I think all great achievements recorded in human history have been made possible precisely because of idealists who were not content with the existing order of their times and continually dreamed and labored alternately until their idealistic concepts took form and shape.

As regent of this chapter of the American College of Chest Physicians I have my share of dreams, big dreams yes, but dreams capable I believe of being translated into reality. I dream of a Philippine Chapter whose members are imbued with the highest ideals of service; men who are not dazzled by lucre alone. Men who keep high the standards of righteousness, the while constantly adding to their knowledge in lessening human suffering and prolonging life. Men who stamp character as a bedrock of the profession, without which attainment is not worth one copper coin! I dream of a Philippine Chapter as potent in the formulation of government policies concerning tuberculosis as our mother society undoubtedly is in America. I also dream of a Philippine Chapter whose contributions to the world of scientific research shall be a by-word in the annals of medicine in our own country, in the same way that contributions to medical research of the American College of Chest Physicians together with those of other organized scientific societies in the United States are the pride not only of our colleagues there in particular but also of the American people in general. In the same way that their efforts have lessened to a great extent the mortality from tuberculosis of the American people so I hope similar efforts on our part will further reduce the deaths among Filipinos due to this disease.

To the elevation of the standard of ethics among our members; to the promotion of more intensive and extensive research in chest work and to the cultivation of more broadening and gratifying contacts not only between our co-members but also between them and members of other scientific and cultural organizations as well, *I pledge my modest efforts.*

I thank you for your support during my incumbency. I hope you will extend to my successor the same cooperation you so unselfishly gave me.

With your intelligent cooperation and unstinted support, and with the Almighty's guidance, there is reason to hope that the years ahead will be for all of us richer in service and achievements.

A Modification of the Jackson Bronchoscope

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Since the Jackson system of bronchoscopy has been in almost universal acceptance because of its simplicity of design and standardization of sizes, as well as integration of accessory instruments, this system was studied with a view of adding certain features which facilitated bronchoscopy. This resulted in a bronchoscope with the modifications to be described.

1) *Structural Metal.* The instrument is made entirely of monel, an alloy of nickel and copper with physical as well as chemical properties which made it the metal of choice over other alloys that might have been used for this purpose. Monel is tough, hard (almost non-indentable by tooth trauma), thin yet rigid, and resistant to oxidation at all ordinary medical temperatures. It resists corrosion by all ordinary salts, acids, alkalis, food products, organic substances and waters.

2) *Funnel Aperture.* The head of the bronchoscope is milled with a funnel type of aperture which permits more easy introduction of the long bronchoscopic instruments and also serves to "centre" vision.

3) *Horizontal Side-arm.* In the original Jackson instrument the side-arm protruded from the bronchoscope at an angle and frequently became bent or separated. In the modification the side-arm is horizontal and parellel to the main bronchoscopic tube. This position permits further introduction of the bronchoscope so that almost the full length of the instrument can be exploited. This permits the use of a 40 cms. instrument for almost all cases; the 45 cms. lengths are thus reserved for exceptional occasions. This position of the side-arm does not appear to affect the direction of the flow of gases as these are gently propelled to the distal portion of the bronchoscope.

4) *Anti-fog Device.* The use of a method of preventing condensation of respiratory moisture on the bronchoscopic shield has become almost a constant need for bronchoscopy. Without it vision is constantly fogged and endobronchial manipulation becomes quite difficult. Deflection of the respiratory air on the instrument is effected by a built-in anti-fog device which is part and parcel of the head of the bronchoscope with no loose parts.

*Chief of Thoracic Medicine, St. Francis Hospital, Trenton, New Jersey. Associate in Medicine, Graduate School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania.

5) *The Handle.* Heretofore the handle has been merely an index which served to locate the tip of the distal bevel and had no other use. In the model described the handle is made to secure the light carrier cord to prevent it from constantly dangling in front of the lumen. This is effected by a milled slot in the handle and a small clip attached to the cord which fits securely into the slot.

6) *Removable Oxygen, Anti-fog, and Aspirating Tubing.* It will

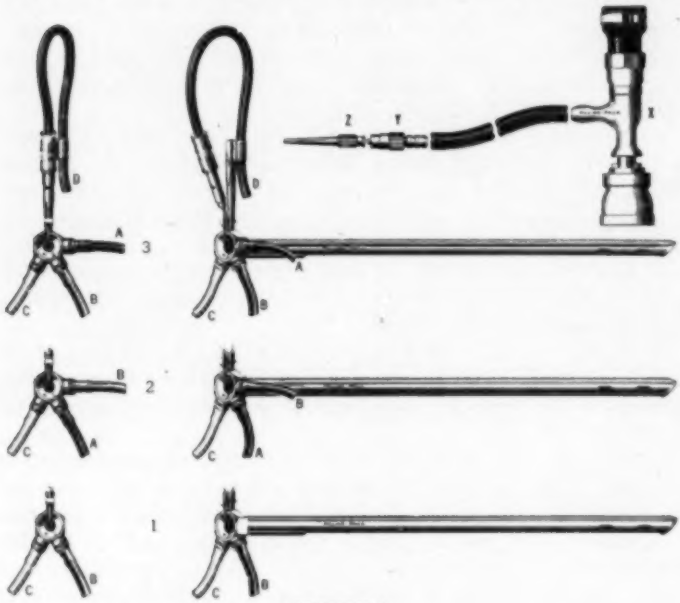

FIGURE 1

1. *Standard Bronchoscope for General Use.* "B" side-arm channel with Luer-lok fitting. "C" anti-fog channel with same type of fitting.
2. *Standard Aspirating Bronchoscope.* The aspirating canal is in the wall of the bronchoscope opposite the light. This type of bronchoscope aspirates constantly in the normal operating position. "A" aspirating channel. "B" side-arm channel. "C" anti-fog channel.
3. *Regular Aspirating Bronchoscope.* The aspirating canal on this model is on the right side. Aspiration is accomplished when the handle is depressed through an arc of 90 degrees. "A" aspirating channel. "B" side-arm channel. "C" anti-fog channel. "D" handle, showing manner of securing the light-carrier cord.

For both types of aspirating bronchoscopes a thumb-valve attachment was designed (not shown) for use when the operator desires intermittent suction. This fits directly to the aspirating channel with a Luer-lok fitting.

"X" Penberthy aspirator and flusher.

"Y" Male component of the "two-in-one" bronchoscopic cleaning adapter.

"Z" Female component of the cleansing adapter.

Note: All these instruments are presently being manufactured by the George P. Pilling and Son Company, 3451 Walnut Street, Philadelphia, Pennsylvania, to whom the author has given the specifications for the instruments described.

be noted that the head of the instrument has Luer-lok adapters which are attached to rubber tubing. This tubing, which is not completely shown in the illustration, is a length of about one foot which has a male Luer-lok fitting at one end and a female fitting at the other. This arrangement serves a two-fold purpose: it permits effective sterilization of these sections along with the remainder of the bronchoscopic instruments; and permits the instrument nurse to detach either the pressure, vacuum, or oxygen hose without touching the bronchoscope or interfering with the operator. This is especially helpful when only one pump is being used and attachment to spray instruments or specimen receptacles is required during the operation.

7) *Bronchoscopic Cleansing Attachments.* To service the improved bronchoscope a simple "two-in-one" cleansing attachment was designed. Its use obviated special plumbing fixtures and permitted the use of an ordinary faucet equipped with a Penberthy aspirator. This permits forcible flushing of all the channels of the instrument as well as aspiration of detergents or antiseptics through these same channels. Residual moisture may be blown out with the bronchoscopic pressure pump, thus obviating the tedious insertion of worsted cleaners. These same attachments may be used to service all the tubular instruments generally used in bronchoscopy.

The Present Status of Vaccination in Tuberculosis Control Programs

A Report of the Council on the Management and Treatment of Diseases of the Chest, American College of Chest Physicians

Considerable attention has recently been given to BCG vaccination in the public press. From this publicity the impression might be gained that this procedure alone holds promise of real control of tuberculosis. Since such an impression might postpone indefinitely the establishment and extension of accepted control measures, this statement of the status of vaccination in tuberculosis control programs is issued.

1) Control measures in tuberculosis should be directed at eradication of the disease as a major cause of death or disability.

2) The marked improvement in tuberculosis mortality figures, particularly for the ages under 30, demonstrates the effectiveness of the present control program.

3) The low rate in children and the continuing high rates in adults over 50 emphasize the location of the problem at the older age levels rather than in children. Under these circumstances, the efficiency of a method of tuberculosis control would be measured by its effect on the mortality from tuberculosis in the older age group, rather than in children.

4) The addition of a vaccine to the present control program requires both careful and adequate consideration. Of the vaccines proposed, BCG has been used most widely and is the one most often discussed.

5) This has been used for more than 25 years and recently many millions of people have been vaccinated. However, it must be stated that there is no evidence that meets strict scientific requirements demonstrating that BCG affects the control of tuberculosis, despite the very suggestive results of a few studies.

6) Because of the above fact and because there is no general agreement among investigators anywhere in the world on such fundamental matters as the preparation of vaccine, the method of vaccination, what constitutes a successful vaccination, how resulting immunity may be measured, how long such immunity lasts, etc., the procedure would seem to be still in the investigational period.

7) It is therefore recommended that investigation of vaccination in tuberculosis be continued and increased under standard and stringently controlled conditions. This investigation should be designed to determine if the vaccine is indeed effective and what the limitations of its use might be. It would seem desirable that in each country, one agency preferably the official health agency, should have control of the investigation.

8) Until this has been determined and until these controlled studies are completed, the use of BCG vaccine should be limited to such investigative studies.

9) At the present time the methods which have been proved effective in tuberculosis control should be increasingly applied to all segments of the population, regardless of decreasing mortality figures, so long as tuberculosis remains an important cause of death. These measures include mass x-ray case finding, early diagnosis, rapid institution of treatment, isolation of open cases, and the restoration of the patient to normal life.

Council on the Management and Treatment of Diseases of the Chest

Edwin R. Levine, Chicago, Illinois, Chairman
Donato G. Alarcon, Mexico City, Mexico, Vice-Chairman
Arthur M. Olsen, Rochester, Minnesota, Secretary
Mortimer A. Benioff, San Francisco, California
Otto C. Brantigan, Baltimore, Maryland
John F. Briggs, St. Paul, Minnesota
Alexander Libow, Miami Beach, Florida
Edward H. Robitzek, New York, New York
John W. Stacey, Tucson, Arizona.

College News

NEXT ANNUAL MEETING

The Seventeenth Annual Meeting of the American College of Chest Physicians will be held in Atlantic City, New Jersey, June 7-10, 1951. The Committee on Scientific Program for the 1951 meeting is comprised of the following members:

Edwin R. Levine, Chicago, Illinois, Chairman
Alvan L. Barach, New York, New York
Paul H. Holinger, Chicago, Illinois
Richard H. Overholt, Brookline, Massachusetts
Leo G. Rigler, Minneapolis, Minnesota
Harold G. Trimble, Oakland, California.

Physicians interested in obtaining places on the scientific program are invited to submit titles and abstracts of their material to Dr. Edwin R. Levine, chairman of the committee, 109 N. Wabash Ave., Chicago, Ill.

SAN FRANCISCO POSTGRADUATE COURSE IN DISEASES OF THE CHEST

The California Chapter of the American College of Chest Physicians in cooperation with the University of California Medical School and the Stanford University School of Medicine will sponsor a postgraduate course in diseases of the chest in San Francisco, California, February 19-23, 1951. Serving with Dr. Seymour M. Farber, Chairman of the Postgraduate Course Committee are Dr. Alfred Goldman, Dr. H. Corwin Hinshaw, Dr. David T. Proctor and Dr. Buford H. Wardrip. Dr. J. Winthrop Peabody, Chairman of the Council on Postgraduate Medical Education of the College will serve as an Ex-Officio member of the Committee.

Outstanding authorities will present the clinical, surgical, pathological, radiologic and physiologic aspects in the management and treatment of chest disease. Industrial dust diseases, effects of atomic radiation upon the chest, nutritional considerations in diseases of the chest, psychosomatic problems in pulmonary disease and BCG are some of the many subjects scheduled for presentation.

This course is open only to qualified physicians and requests for registration are to be addressed to Dr. Stacy R. Mettier, Head of Postgraduate Instruction, Medical Extension, University of California Medical Center, San Francisco 22, California. Fee for the course is $50.00. Check or money order should accompany request for enrollment.

POSTGRADUATE COURSE TO BE PRESENTED BY COLLEGE AND GENERAL PRACTITIONERS

The American College of Chest Physicians and the Milwuakee Chapter of the American Academy of General Practice will present a postgraduate course in diseases of the chest during April, 1951. The course will be presented on four consecutive Wednesday afternoons at the auditorium of the Milwaukee Children's Hospital in Milwaukee.

Official approval by the Wisconsin Chapter of the American Academy of General Practice as an accredited course in postgraduate education for its members has been granted the course and curriculum. Enrollment will be limited to 85 applicants and the fee for the entire course is $25.00, which will be used to defray traveling expenses for out-of-town speakers and administrative details.

All practical aspects of etiology, diagnosis, clinical management and treatment of diseases of the chest will be covered by recognized authorities. Speakers have been chosen from the state of Wisconsin as well as from the country at large.

Dr. Mischa J. Lustok is the general chairman for the program and Dr. Donald C. Ausman, secretary of the Milwaukee Chapter of the American Academy of General Practice, is secretary for the course. All communications should be addressed to Dr. Ausman at 2524 West Keefe Avenue, Milwaukee 6, Wisconsin.

NEW YORK POSTGRADUATE COURSE IN DISEASES OF THE CHEST

One hundred and ten physicians from Canada, India, China and the United States registered for the Fourth Annual Postgraduate Course in Diseases of the Chest. The course opened on Monday, November 13, 1950 at the Hotel New Yorker, New York City and ended on Saturday, November 18. Dr. Edgar Mayer served as Chairman of the Postgraduate Course Committee and Dr. Frank R. Ferlaino as Secretary. Dr. Emil Naclerio was Chairman of the Committee on Scientific assembly.

The following physicians registered:

Hilmi Akin, Brookline, Massachusetts
Cmdr. B. Anastasiades (M.C.) R.H.N., St. Albans, New York
Julian J. Ascher, Buffalo, New York
Sedad Atikkan, Boston, Massachusetts
Paul Auspitz, Bronx, New York
Esdras E. Autotte, Montreal, Canada
Roslyn Barbash, Teaneck, New Jersey
C. S. Barker, Montreal, Canada
Marvin Barnett, Aspinwall, Pennsylvania
Morris Bastacky, Aspinwall, Pennsylvania
Karl T. Benedict, Worcester, Massachusetts
Asher Black, Syracuse, New York
Meyer Bloom, Johnstown, Pennsylvania
Irving P. Borsher, Newark, New Jersey*
Joseph R. Boyle, Rutland Heights, Massachusetts
Joseph S. Burkle, Philadelphia, Pennsylvania
Ellis P. Burns, Montgomery, Alabama
Donald Cant, Hamilton, Canada
Christy F. Castiglia, Buffalo, New York
Thomas C. Catalano, Yonkers, New York
William C. Clyne, New York, New York*
William E. Cook, Fayetteville, North Carolina
W. F. Cormier, Montreal, Canada
Louis A. Crismond, Quincy, Massachusetts
James O. Crittenden, Sewickley, Pennsylvania
Fred F. DeBold, Keene, New Hampshire
Albert DeMatteis, Altoona, Pennsylvania
C. J. Doherty, Cornwall, Canada
Henry B. Doust, Syracuse, New York*
Theodore M. Ebers, West Hartford, Connecticut
Winslow S. Edgerly, New York, New York
Howard K. Edwards, Miami, Florida*
Roger O. Egeberg, Los Angeles, California

NEW YORK POSTGRADUATE COURSE IN DISEASES OF THE CHEST

Some of the physicians and instructors who participated in the Fourth Annual Postgraduate Course in Diseases of the Chest of the American College of Chest Physicians.

Max A. Elias, Brooklyn, New York
B. J. Ellmers, New Milford, New Jersey*
Joseph G. Falk, Kew Gardens, New York
A. J. Faridi, Lucknow, India
John E. Fenton, Rutland Heights, Massachusetts
Santo Finocchiaro, New York, New York
Berry Franklin, New Bedford, Massachusetts
Gerald Gauvin, Edmundston, Canada
C. A. Gaynor, Scranton, Pennsylvania**
H. Harold Gelfand, New York, New York
Louis H. Geronimus, Rego Park, Queens, New York
S. B. Gibson, Williamsport, Pennsylvania*
Roland Gluck, Brooklyn, New York
Paul G. Goerner, Augusta, Georgia
Nathan G. Gordon, Akron, Ohio*
Robert Green, Richmond, Virginia
T. H. Gridley, Montreal, Canada
William Grosfeld, Decatur, Alabama*
J. S. Hazen, Gravenhurst, Canada*
G. W. Hobson, Brecksville, Ohio
Samuel Hock, Hillside, New Jersey
Warren L. Hollis, Richland, New York
Lawrence T. Hopkins, Bedford, Massachusetts
Phillip W. Horn, Jacksonville, Florida*
Ming-Juan Hsu, China
Frederick D. Hughes, Rochester, New York
Per Jensen, Farmingdale, L. I., New York
Kermit T. Johnstone, Saginaw, Michigan
D. Kasler, Toronto, Canada
Hugh C. Keenan, Sarnia, Canada
Maurice D. Kenler, New Bedford, Massachusetts*
W. R. Kennedy, Montreal, Canada
Richard H. Kirkland, Richmond, Virginia
Lester L. Klapper, Plainfield, New Jersey**
Joseph Klugler, Northampton, Massachusetts***
Arthur M. Knight, Jr., Waycross, Georgia
J. Denis Langlois, Montreal, Canada
Virginia Langworthy, Scarsdale, New York
Philip Lipton, Bath, New York
Charles S. Livingston, Outwood, Kentucky*
H. Paul Longstreth, Buffalo, New York
John F. Loughlin, Togus, Maine
Louise Lowe, Hackensack, New Jersey**
Cecil Marquez, New York, New York
W. D. Mazzacane, Old Orchard Beach, Maine
D. McCallum, Ottawa, Canada
H. J. McKenna, Fall River, Massachusetts
G. W. Millett, Montgomery, Alabama
Hector Nahas, Northville, Michigan
J. C. Nash, Decatur, Alabama
J. A. Newberry, New York, New York
Irving A. Oberlander, Syracuse, New York
Antonio Ordonez, Quezon City, The Philippines
M. Osterreicher, St. Hyacinthe, Canada***
Jacob Perlstein, Brooklyn, New York
John Pois, South Orange, New Jersey
Samuel D. Radin, Butler, Pennsylvania***
J. T. Roberts, Buffalo, New York
Churchill Robertson, Roanoke, Virginia*
Joseph P. Robinson, Bethlehem, Pennsylvania
Abraham N. Saperstein, Bellerose, New York
Frank Seldon, Manchester, New Hampshire*
William H. Shafer, Winchester, Virginia
William C. Silverman, Newark, Delaware
Maurice J. Small, Staten Island, New York
P. Smit, New York, New York
William A. Smith, Raleigh, North Carolina**

Casimir Staniszewski, Detroit, Michigan
Richard M. Starr, New London, Connecticut
Daniel Thaw, Canandaigua, New York
Bernard Tolnick, Mattapan, Massachusetts
Frank R. Trigg, Norfolk, Virginia**
C. R. Weber, Windsor, Canada***
John J. Weber, Woodstock, Canada
Edward G. Whipple, Rochester, New York
Francis J. Welch, Portland, Maine*
Louis S. Zwick, Wadsworth, Ohio

*Fellow, American College of Chest Physicians.
**Associate Fellow, American College of Chest Physicians.
***Associate Member, American College of Chest Physicians.

College Chapter News

ARGENTINE CHAPTER

The Argentine Chapter of the College held its annual meeting at Mar del Plata on November 25. The opening speech was given by Dr. Guido Pezzati, President of the Medical College of Mar del Plata, and the assembly was then addressed by Dr. Oscar A. Vaccarezza, Buenos Aires, President of the chapter.

A scientific program was presented in which the following physicians read papers: Drs. Oscar A. Vaccarezza, Mario A. Brea, Andres Santas, Jorge Taiana, and Fernando Tricerri. A luncheon meeting was held at the Nueva Ostende Hotel followed by a business meeting. The following officers were elected for 1951:

Paulino A. Rojas, La Plata, President,
Tomás de Villafañe Lastra, Cordoba, Vice-President,
Francisco Arrambarri, La Plata, Secretary-Treasurer.

On the following day, Sunday, a dinner was given which was organized by the Medical Circle and the Medical College of Mar del Plata.

ILLINOIS CHAPTER

The Illinois Chapter of the College held a joint meeting with the Peoria Medical Society on November 21 at the Jefferson Hotel in Peoria. At the scientific session Dr. George W. Holmes of Chicago spoke on "The Early Diagnosis and Surgical Treatment of Bronchogenic Carcinoma" and Dr. Charles K. Petter of Waukegan spoke on the subject of "The Management of Pulmonary Tuberculosis in Persons Past the Age of Forty."

Another meeting of the chapter took place in Chicago at the Congress Hotel on December 15. Two subjects were discussed in the scientific program: 1) The Use of ACTH and Cortisone in Asthma, Clinical Experiences and Immunological, Tissue Reactivity and Spirometric Studies, and 2) Clinical and Laboratory Effects of ACTH and Cortisone on Patients with Pulmonary Tuberculosis.

The first subject was presented by Drs. Samuel M. Feinberg, Thurman B. Dannenberg, Alan R. Feinberg and Saul Malkiel. Drs. Smith Freeman and Jennings Fershing presented the second subject. A general discussion followed.

MEETING OF OFFICIALS OF NEW ENGLAND STATES CHAPTER

A meeting of the officials of the College in the New England States was held at the home of Dr. Richard H. Overholt in Dedham, Massachusetts. Dr. Overholt is Past-President of the American College of Chest Physicians and the New England States Chapter of the College. The meeting took place on Sunday, December 10 and those present were: Dr. Edward A. Greco, Portland, Maine, Regent of the College for the New England States; Dr. Moses J. Stone, Boston, President of the New England States Chapter; Dr. Robert B. Kerr, Manchester, Governor of the College for New Hampshire; Dr. Frank A. Merlino, Providence, Governor of the College for Rhode Island; Dr. Hubert A. Boyle, New Bedford, Governor of the College for Massachusetts; Dr. John B. Andosca, Cambridge, Secretary of the New England States Chapter; and Dr. J. J. Hennessey of Hartford, who represented Connecticut at the meeting.

Mr. Murray Kornfeld of Chicago, Illinois, the Executive Secretary of the American College of Chest Physicians, flew to Boston from New York City where he had been attending various conferences, to attend the meeting. He spoke to the gathered officials on the various activities of the College and discussion followed concerning plans for the New England Chapter.

MEXICAN CHAPTER

The Mexican Chapter of the College is planning a meeting to follow the Fourth National Congress of Tuberculosis and Silicosis which is to be held at San Luis Potosi, Mexico, at the Central Hospital during the week of January 21-27, 1951. A number of members of the College will read papers at the Congress and at the chapter meeting, among them are: Drs. Etienne Bernard and Olivier Monod of Paris, France; Drs. Francisco Partearroyo and Jose Abelló Pascual of Madrid, Spain; Dr. Irving Sarot of New York City; Dr. Burgess Gordon of Philadelphia, Pennsylvania; and Dr. Jerome Head of Chicago, Illinois.

NEW JERSEY CHAPTER

The New Jersey Chapter of the College and the Passaic County Medical Society held a meeting at the Valley View Sanatorium on November 21, 1950. The scientific program presented consisted of Dr. H. McLeod Riggins, who spoke on "Diagnosis and Treatment of Chest Disease" and Dr. Homer H. Cherry whose subject was "Thiosemicarbazone Treatment of Active Pulmonary Tuberculosis.

NEW YORK STATE CHAPTER

The annual meeting of the New York State Chapter of the College will be held at the Hotel New Yorker, New York City, on February 8. The following program will be presented:

Morning Session:

"The Use of ACTH and Cortisone in the Management of the Patient with Severe Bronchial Asthma,"
Maurice S. Segal, Boston, Massachusetts.

Discussion: Bret Ratner, New York City.

"Progress in the Management of Chronic Beryllosis with Cortisone and ACTH,"
H. E. Tebrock, New York City.

"Pitfalls in the Diagnosis of Disseminated Pulmonary Lesions,"
David Ulmar, New York City.

Discussion: Leonard Greenberg, New York City.

Luncheon Meeting:

Guest Speaker: Chevalier L. Jackson, Philadelphia, Pennsylvania, President-Elect, American College of Chest Physicians.
"The Significance of the Bronchopulmonary Segment."

Afternoon Session:

"Segmental Resection in One Hundred Consecutive Cases of Pulmonary Tuberculosis,"
J. Maxwell Chamberlain, New York City.

Discussion: Maurice J. Small, New York City.

"The Diagnosis of Diffuse Lesions of the Lung by Biopsy,"
Karl P. Klassen, Columbus, Ohio.

Discussion: Charles P. Bailey, Philadelphia, Pennsylvania.

"The Surgical Management of Intrathoracic Tumors,"
William A. Hudson, Detroit, Michigan.

Discussion: William L. Watson, New York City.

NORTH CAROLINA CHAPTER ORGANIZED

The North Carolina Chapter of the College was organized on November 24, 1950. The meeting took place at the Veterans Administration Hospital at Oteen with Dr. Curtis Crump, Governor of the College for North Carolina, as acting chairman.

The meeting was opened by an address of welcome by General John B. Wogan, manager of the Veterans Hospital at Oteen. Dr. William S. Schwarts, chief of professional services, then welcomed the members on behalf of the professional staff.

A nominating committee was appointed comprised of Dr. C. C. Orr

and Dr. William Smith. The following slate of officers was submitted and approved by the membership present:

E. W. Schoenheit, Asheville, President,
J. H. Matthews, Asheville, Vice-President,
Leon H. Feldman, Asheville, Secretary-Treasurer.

It was voted that an annual meeting should be held, one year in the western part of the state and alternate years in the eastern part of the state. There were fifty people present at the meeting. The following scientific program was presented:

"The Tension Cavity,"
Benjamin P. Sandler.

"Massive Tuberculous Pneumonia: Therapeutic Review of 75 cases,"
Ralph Moyer.

"Decortication of the Lung for Empyema and Tuberculosis,"
Julian Moore.

"Beryllium Pneumonitis, Case Report, Review of Literature, and Legal Implications,"
Norman Anderson.

"Anxiety Factors and the Use of Insulin in Tuberculosis,"
Philip Morgenstern.

"Scleroderma with Pulmonary Complications,"
Louis Hayman.

Movie: "Prevention of Post-Thoracoplasty Deformities,"
James D. Murphy.

Dr. M. Jay Flipse, Miami, Florida, Regent for the district, was scheduled to attend the meeting. He advanced toward Asheville, but was grounded at Atlanta, Georgia and was obliged, because of inclement weather, to retreat to Miami.

PUERTO RICO CHAPTER

The Puerto Rico Chapter of the College held a meeting on December 14, during the annual session of the Medical Association of Puerto Rico, December 12-17. The following invited speakers appeared on the scientific program:

"The Esophagus and Its Diseases,"
Louis H. Clerf, Philadelphia, Pennsylvania.

"Newer Aspects on the Defense of the Body Against Bacterial Infection,"
Pedro Domingo, Havana, Cuba.

SOUTHERN CHAPTER

The Seventh Annual Meeting of the Southern Chapter of the College was held at the Statler Hotel, St. Louis, Missouri on November 12 and 13, just prior to the meeting of the Southern Medical Association. The following officers of the chapter were elected for the coming year:

M. Jay Flipse, Miami, Florida, President,
Hollis E. Johnson, Nashville, Tennessee, First Vice-President,
Duane M. Carr, Memphis, Tennessee, Second Vice-President,
George R. Hodell, Houston, Texas, Secretary-Treasurer.

College News Notes

Four new Corresponding Associate Editors have been added to the staff of the official journal of the American College of Chest Physicians, *Diseases of the Chest*. They are Professor Manoel de Abreu, Rio de Janeiro, Brazil; Dr. Andre Meyer, Paris, France; Dr. Papken S. Mugrditchian, Beirut, Lebanon; and Dr. Juda M. Pauzner, Petach Tikva, Israel.

A paper on "An Approach to the Emotional and Psychiatric Problems of Tuberculous Patients" was prepared by Dr. Phineas J. Sparer, resident psychiatrist at the Downey Veterans Hospital, Downey, Illinois, for publication in the journal of the Illinois Public Aid Commission. Dr. Sparer is a member of the Medical Advisory Board of the Dr. Julian D. Levinson Foundation for Research in Pediatric Neurology.

Dr. John H. Gibbon, Jr., Director of Surgical Research at the Jefferson Medical College in Philadelphia, lectured on "The Present Status of Mechanical Heart and Lung Machines" on December 11 in the graduate lecture program of the University of Virginia Medical School.

Dr. Arthur Q. Penta, Schenectady, New York, a graduate of the University of Vermont, represented his Alma Mater at the Centennial Convocation of the Women's Medical College of Pennsylvania which was held recently in Philadelphia.

Dr. William E. Ogden, Toronto, Regent of the College for Canada, served as President this year of the Ontario Laennec Society. The society held a meeting in Toronto on October 27 and the following College members presented papers in the program: Drs. T. G. Heaton, P. W. Hardie, H. S. Coulthard, Gladys Boyd, K. F. Davis and H. J. Sullivan.

Dr. John W. Middleton, Galveston, Texas, has been promoted to associate professor of internal medicine at the University of Texas Medical Branch at Galveston. He will be the director of the new Ziegler Memorial Tuberculosis Hospital to be erected in association with the Medical Branch Hospitals. Dr. Middleton is also director of the chest clinic of the Medical Branch.

Dr. Roger Hemphill of Wood, Wisconsin spoke before the Metropolitan Section of the Wisconsin Chapter of the College at the Medford Hotel on November 24, 1950. His subject was "Experience with Terramycin in Tuberculosis."

Dr. Moses J. Stone, Boston, Massachusetts, Vice-Chairman of the Council on African and Eastern Affairs of the College addressed the Israel Chapter of the College at the Kupath-Cholin Sanatorium, Petach-Tikvah, Israel on October 9, 1950. Dr. Stone spoke on "The Modern Trends in the Treatment of Tuberculosis."

ALVAREZ SUCCEEDS ALBRECHT AS EDITOR OF "GP"

F. Kenneth Albrecht

When the American Academy of General Practice decided to publish an official journal, the editorial committee spent nearly a year seeking a physician with special talents and abilities to qualify him as medical editor. This person was found in Dr. F. Kenneth Albrecht, who was appointed in the fall of 1949. He was born in Pennsylvania in 1909. He had been a child prodigy in music and achieved professional recognition while still a boy. He was successful in playing, arranging and composing, and was enjoying a lucrative career when he decided to study medicine. He graduated from St. Louis University School of Medicine in 1939. After completing an internship he was admitted to the regular corps of the United States Public Health Service where tours of duty took him to many places and provided much information and valuable experience. His work was of such quality that he became clinical director of the United States Marine Hospital in Baltimore. In 1946 he was sent to Germany as medical consultant to the State Department. The next year he became medical editor of the Williams and Wilkins Company, where he edited *Current Medical Digest*, which reaches 110,000 practitioners of medicine monthly. His work was of an excellent quality, but he desired an opportunity for clinical contacts, postgraduate work, etc.

Walter Alvarez

While in St. Louis University Dr. Albrecht gained a large volume of knowledge in diseases of the chest from Professor H. I. Spector, who inspired so many students and physicians to work in this field. While with the United States Public Health Service, Dr. Albrecht received special postgraduate training in tuberculosis at the Herman Kiefer Hospital in Detroit. He had such a burning desire to be ac-

tively engaged in diseases of the chest and he was so highly qualified for this work that he accepted the directorship of the Division of Tuberculosis Control of the Kansas State Board of Health in January, 1949. On January 10, 1950, he wrote: "I really think we have a program now which can stand on its own with that of any other state, and I am sure we will begin to get good results and most of all, build up much better spirit between the practicing physicians and our Tuberculosis Control Division." He was planning to launch a certification of schools project on the basis of tuberculosis work in progress throughout the State of Kansas.

Dr. Albrecht was an excellent writer. He was author of two books: (1) *Modern Management in Clinical Medicine* published in 1946 and (2) *Practical Therapeutics* in collaboration with members of the Jefferson Medical College staff in Philadelphia. The entire printing of this second book was sold within five months. In March, 1949, he emphasized many important points with reference to tuberculosis in immigrants in an article published in the *Journal of the American Medical Association*, and in October of the same year a letter by him to the editor of the *American Review of Tuberculosis* was published under the title, "What's Wrong with Mass X-ray Surveys?" Here he manifested a great deal of practical information and made recommendations which should be accepted everywhere.

Thus Dr. Albrecht's unusual ability to write and edit, combined with his wide store of medical information, practical experience, and particularly his keen understanding of and desire to be of assistance to the general practitioner, made him the ideal person to edit *The General Practitioner*. He accepted the editorship with great enthusiasm and worked feverishly on the preparation of the first issue. On December 29, he said: "We are committed to publish a streamlined, dynamic medical journal with the sole object directed toward making the general practitioner the best informed medical man anywhere. We physicians never cease being students as this journal will portray postgraduate medical education of the highest quality." In this letter he also said: "On February 1, I will go to Ann Arbor, Michigan, for four months of postgraduate study." Here he was to complete the work for a degree in Public Health. At the end of this period he said he was to move to his permanent home, Mill on the Manor, Monkton, Maryland, which was to be the permanent site of the editorial office of "GP." He and the managing publisher, Mac F. Cahal, had made all arrangements for publication of the first issue.

On January 31, while en route with his family from Topeka to Ann Arbor, Dr. Albrecht was seriously injured in an automobile accident. He was making a good recovery, when he suffered a pulmonary embolism and died suddenly on March 8, 1950, just as the first issue of "GP" was going to press. With special interest in diseases of the chest, Dr. Albrecht was a member of the National Tuberculosis Association, the American Trudeau Society, and was a Fellow of the American College of Chest Physicians. He will always be remembered and revered by the general practitioners of America as the first medical editor of "GP" for which he so fervently worked.

When Dr. Albrecht died so suddenly, the future of "GP" seemed to be in desperate straits. However, Managing Publisher Cahal and the publications committee calmly instituted a search for a new editor. With reasonable promptness they found the physician, most of whose pro-

fessional life had been devoted to preparation for just such a position. Dr. Walter Alvarez had long been a practitioner, educator and author. He had served as editor of the *American Journal of Digestive Diseases* and also of *Gastroenterology*. He had contributed sections for several important books and had published more than 675 articles in the medical literature. Dr. Alvarez has long been senior consultant in the Division of Medicine at the Mayo Clinic. Having reached the age of retirement at the Mayo Foundation, he was appointed editor of "GP" on April 2. He has moved to Chicago where he will reside and conduct the medical editorial activities of "GP." Thus, with Dr. Alvarez as medical editor and Mr. Cahal as managing publisher, the success of "GP" is assured.

J. A. Myers, M.D.

POSTGRADUATE COURSE IN BRONCHOESOPHAGOLOGY

Postgraduate courses in bronchoesophagology will be given by Drs. Chevalier Jackson and Chevalier L. Jackson during the periods January 22 to February 2 and March 5 to 16, 1951. For application forms and further information please communicate with the Department of Bronchoesophagology, Laboratory 604, Temple University School of Medicine, 3400 North Broad Street, Philadelphia 40, Pennsylvania.

IX CONGRESS OF LATIN AMERICAN TUBERCULOSIS SOCIETIES (ULAST)

The IX Congress of Latin American Tuberculosis Societies (ULAST) will be held at Guayaquil, Ecuador during the week of July 14-22, 1951. Dr. Jorge Higgins, Governor of the College for Ecuador, is President of the Congress. It is planned that the organizational meeting of the Ecuador Chapter of the College will be held in conjunction with the Congress.

COLLEGE EVENTS

17th Annual Meeting, American College of Chest Physicians, Atlantic City, New Jersey, June 7-10, 1951.

Southern Postgraduate Course, Nashville, Tennessee, January 22-27, 1951.

Annual Meeting, New York State Chapter, New York City, February 8, 1951.

San Francisco Postgraduate Course, San Francisco, California, February 19-23, 1951.

Philadelphia Postgraduate Course, Philadelphia, Pennsylvania, March 26-30, 1951.

Milwaukee Postgraduate Course for General Practitioners, Milwaukee, Wisconsin, April, 1951.

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POSITIONS AVAILABLE

Senior Resident Physician wanted for a modern two hundred and forty bed New Jersey Tuberculosis Sanatorium. An American graduate with adequate training in a modern tuberculosis sanatorium. Experience in selecting surgical tuberculosis cases and with postoperative care is required. Civil Service examination not required. We do not have a State income tax. Doctor with wife and one child acceptable. Complete maintenance on the grounds granted. Salary open. Give complete information in first letter. Address all inquiries to Box 247B, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois.

Position as Assistant Physician available January 1st; 100-bed county sanatorium, California resort area. Excellent opportunity for training chest surgery. Starting salary $400 per month plus furnished house and family maintenance. Apply to Medical Director and Superintendent, Ahwahnee Sanatorium, Ahwahnee, California.

Superintendent and medical director wanted for 100 bed tuberculosis sanatorium in south-east Minnesota. Modern, well equipped. Full maintenance. Salary open. Address correspondence to Mr. Eldridge Peters, Chairman, Board of Directors, Mineral Springs Sanatorium, Cannon Falls, Minnesota.

Staff physician wanted. Kentucky's new six hospital tuberculosis program needs physicians in staff capacity. $5,000.00 per year plus maintenance. Eligibility for Kentucky licensure required. Contact T. F. Moore, Jr., Executive Director, State Tuberculosis Sanatoria Commission, Frankfort, Kentucky.

Young assistant wanted in practice confined to diseases of the heart and lungs. If satisfactory will be made associate. Both office and sanatorium practice. Salary commensurate with experience. Please send qualifications and photograph. Address Box 217A, American College of Chest Physicians, 500 North Dearborn Street, Chicago 10, Illinois.

ANNOUNCEMENT OF THE PUBLICATION OF "HANDBOOK FOR PHOTOFLOROGRAPHIC OPERATORS"

by the Division of Tuberculosis

When the Brazilian, DeAbreu, first demonstrated the mass use of photofluorography in 1938, the world little imagined that the brief span of 12 years would see it grow to its present usefulness. During the one year of 1949, more than 14 million persons in the United States alone were screened for tuberculosis by chest photofluorography, and mass survey activities are continuing to expand all over the country.

As a means of facilitating its own part in the vast tuberculosis case-finding program of today, the Public Health Service, through its Division of Tuberculosis, has produced a "Handbook for Photofluorographic Operators" as a technical guide for its own photoflorographic field teams. The publication outlines the principles of photofluorography in simple terms, describes the components and characteristics of photofluorographic machines, and presents detailed operating instructions for the most commonly used types of equipment. Photofluorographic film processing instructions are also given, as well as directions for adjusting and testing equipment. The final chapter of the handbook discusses the all-important subjects of radiation hazards and protective measures. Illustrations are numerous and include both photographs and schematic diagrams of photofluorographic equipment.

Although the manual has been written expressly for the use of Public Health Service photofluorographic personnel, it will serve as a useful reference guide for all users and operators of photofluorographic equipment. Copies are now available at the Government Printing Office, Superintendent of Documents, Washington, D. C., at a cost of $.45 each.

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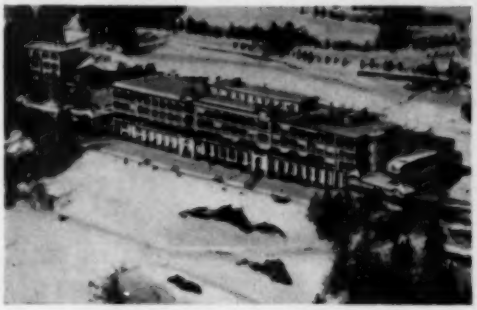

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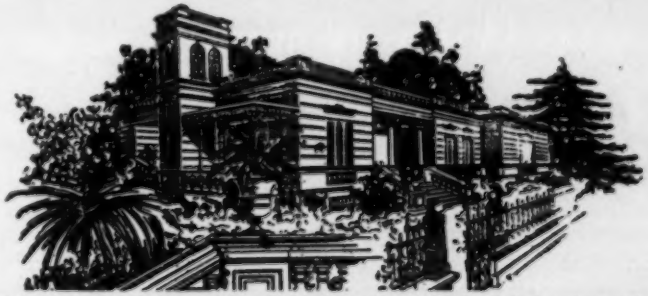

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MARYKNOLL SANATORIUM
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PALMER SANATORIUM
Springfield, Illinois

ROCKY GLEN SANATORIUM
McConnelsville, Ohio

SCHATZALP SANATORIUM DAVOS
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ST. JOHNS SANITARIUM
Springfield, Illinois

SOUTHERN SIERRAS SANATORIUM
Banning, California

SOUTHWESTERN PRESBYTERIAN SANATORIUM
Albuquerque, New Mexico

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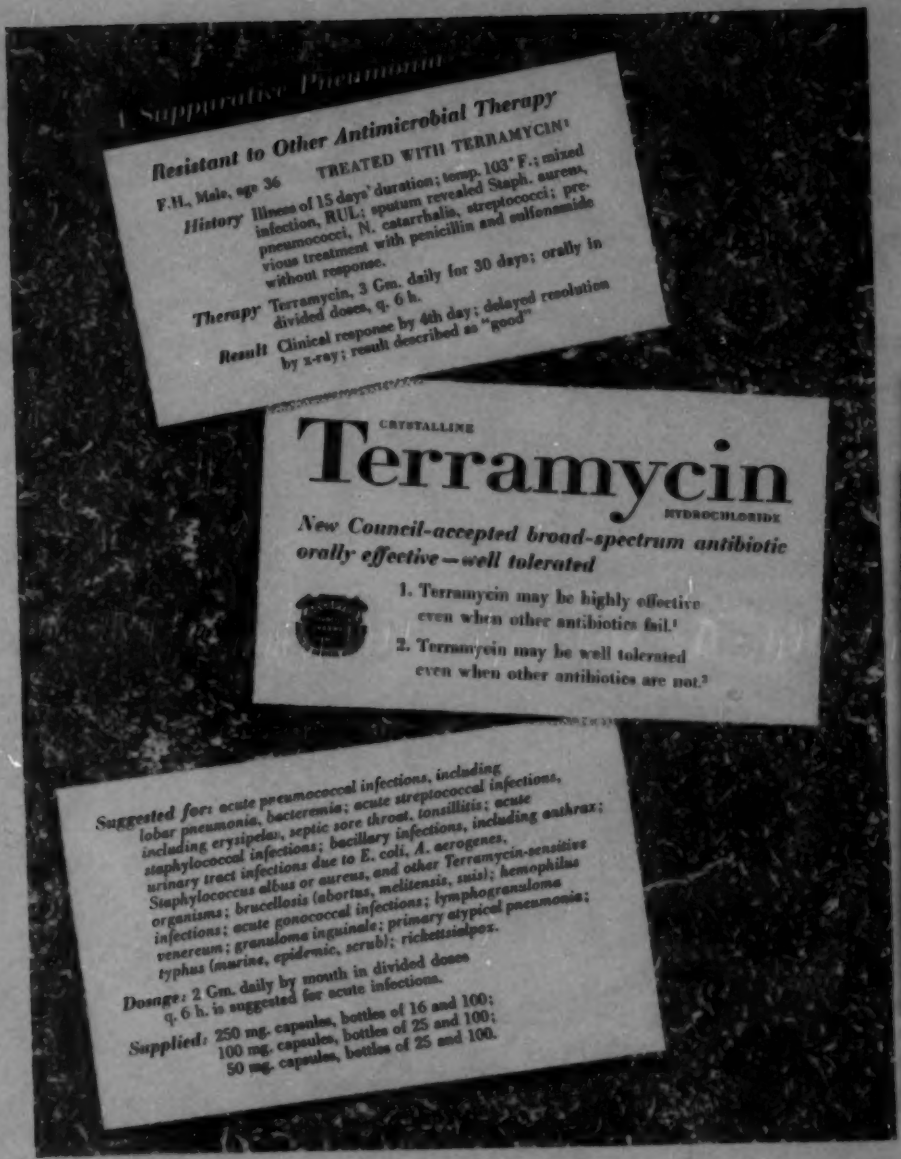
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Resistant to Other Antimicrobial Therapy
F.H., Male, age 36
TREATED WITH TERRAMYCIN[1]
History Illness of 15 days' duration; temp. 103° F.; mixed infection, RUL; sputum revealed Staph. aureus, pneumococci, N. catarrhalis, streptococci; previous treatment with penicillin and sulfonamide without response.
Therapy Terramycin, 3 Gm. daily for 30 days; orally in divided doses, q. 6 h.
Result Clinical response by 4th day; delayed resolution by x-ray; result described as "good"
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1. Wing, F. G.; Lewis, C. H.; Welch, H.; Clark, E. A., Jr.; Johnson, J. G.; Lyons, J. G.; Smith, R. G., and Carney, P. G.: J.A.M.A. 163:1 (May 4) 1957.

2. Harrell, W. E.; Hellman, F. R.; Wellman, W. E., and Gerbracken, L. A.: Proc. Staff Meet. Mayo Clin. 29:93 (April 10) 1954.

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